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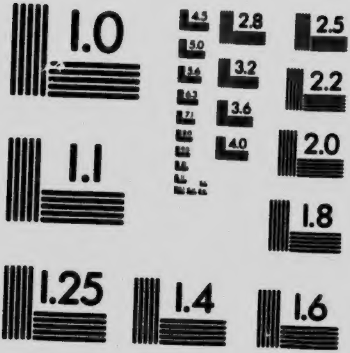

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1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

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Ontario Department of Agriculture

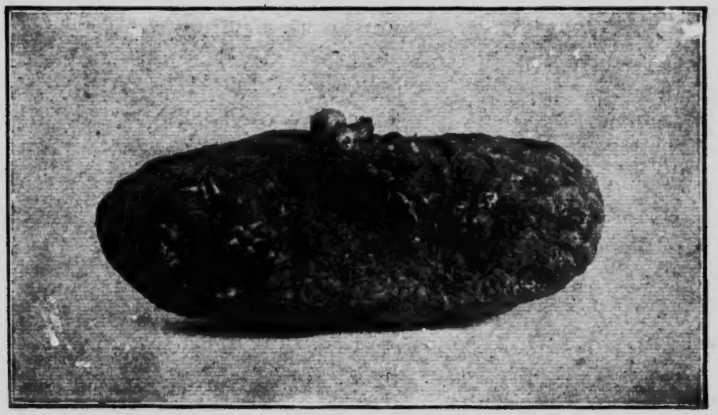
ONTARIO AGRICULTURAL COLLEGE

POTATOES

PROFESSOR C. A. ZAVITZ.

INTRODUCTION.

It is evidently true that potatoes are grown by more people, are used in more homes, and are cooked in a greater variety of ways than any other vegetable produced in Ontario. Fields and patches of potatoes are very common on the farms and in the gardens of the Province. In practically all instances they are grown for home use, but in many cases they are grown also for supplying the local markets and in some localities they are produced for the larger centres of population.



A Study in Potato Growth. A large potato grown in the soil in 1914; small potatoes produced in a dark cellar in 1915; and new sprouts on the small potatoes in preparation for a fresh crop in 1916.

The potato crop of Ontario could be decidedly and economically improved by a more general use of pure, well bred seed of a few of the best varieties, by the adoption of better methods of culture, and by a more complete control of insects and diseases. It should be the aim of every grower to produce large yields of uniform potatoes free from disease and of high table quality. Varieties of potatoes differ greatly not only in yield per acre, but also in freedom from rot and in cooking qualities. For instance, in the trying season of 1915, the varieties of potatoes grown under uniform conditions at the Ontario Agricultural College varied in yield per acre from 13 to 366 bushels, and in amount of rot from less than one to over seventy-four per cent. Some kinds are found to be very susceptible to rot, and others to be almost immune. The table quality of potatoes varies far more than many people realize when mealiness, flavor, and appearance of different varieties are taken into consideration and are carefully determined.

The chief aim in writing this bulletin is to present the results of experiments and of investigations with potatoes carried out at the Ontario Agricultural College and throughout the Province within the past twenty-six years. The information here given should be of real value to our potato growers in their endeavor to improve both the quantity and the quality of the potato crops of Ontario.

Tops and Potatoes produced from a tuber kept in a warm room.

DESCRIPTION.

The potato (*Solanum tuberosum* L.) belongs to the order solanaceæ and to the genus solanum. This genus embraces about eight hundred and fifty species, many of which are ornamental plants. Only about one-half dozen of these species bear tubers, and of these the potato is decidedly the most important. The potato is a tuber and not a root. The roots of a potato plant are fibrous, branched, and extend in various directions in the soil, but mostly in the upper surface. Some of the stems grow upwards in the air and produce leaves, while others grow horizontally in the soil and produce tubers. The latter are called rhizomes, and if brought above ground many produce leaves instead of tubers. Potatoes are simply the enlarged ends of underground stems, and the eyes are really buds. Tubers of different varieties when grown side by side, or even in the same hills, retain their purity. It is supposed, however, that bud variations may occur in potatoes as in other plants. The flowers, fruits and seeds are produced on the upright stems. New varieties are produced from the potato seeds which are about the size of pin-heads, and these new varieties when established can be grown in their purity from year to year. Tubers used for planting are frequently and conveniently referred to as seed potatoes and are entirely distinct from potato seeds.

HISTORY.

Probably the two greatest gifts of America to the rest of the world are potatoes and corn. The potato is a native of mountainous districts of tropical and sub-tropical America, chiefly from Chili to Mexico, and even as far north as Colorado. The potato was cultivated by the Indians for a long period of time before the discovery of America by Columbus. According to history the potato was taken to Spain, Italy, Ireland and England from South and North America in the Sixteenth Century. It was first regarded as a curiosity, and its growth was exceedingly limited. As late as 1771 only two varieties of potatoes were listed, one white and one red. As the value of the potato as a human food became known its cultivation spread gradually. It is now grown throughout the civilized world. Its ease of propagation, its abundant yield, and its excellent food qualities make the potato one of the most popular vegetables for humanity.

COMPOSITION AND USES.

Potatoes are essentially a starchy food. If used alone, they form an unbalanced ration, but if used in conjunction with foods rich in protein such as meat, fish, eggs and milk they become an important factor in forming a well balanced diet. The average percentage composition of raw and of boiled potatoes and the average percentage of digestible constituents of cooked potatoes may be given as follows:

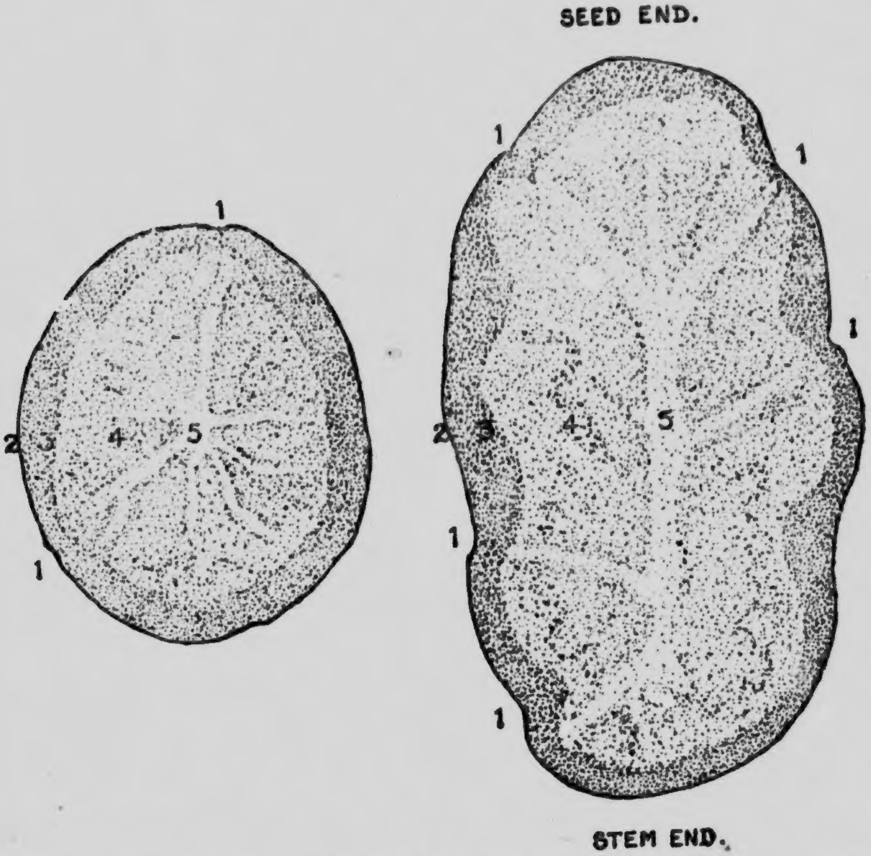
Constituents.	Chemical Composition.			Digestible Nutrients.
	Raw Potatoes.		Cooked Potatoes.	Cooked Potatoes.
	Unpeeled.	Peeled.	Peeled.	Peeled.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Water	78.8	78.3	75.5	....
Protein	2.2	2.2	2.5	1.8
Carbohydrates	17.6	18.4	20.9	19.6
Fat	.1	.1	.1	.1
Ash	1.1	1.0	1.0	....

The carbohydrates are made up of starch, sugar, a small amount of crude fibre, etc. Analyses were made in the Chemical Department of our College of eighty-one lots of potatoes of different varieties and from different soils and localities in Ontario and in New Brunswick. It was found that there was a variation in percentage of dry matter from 16.4 to 26.6, of protein from 1.48 to 2.93 and of starch from 9.57 to 20.74. The average amount of starch from potatoes grown on [illegible] and on light sandy loams was 16.0 per cent. and on heavy clay loams [illegible] cent. It will be seen, therefore, that the amount of starch was very similar [illegible] potatoes grown on soils of decidedly different character. In a test of [illegible] varieties of potatoes, grown under similar conditions of soil and climate, there were wide differences in chemical composition. The table quality of potatoes was influenced more by variety than by all other factors combined such as locality, soil and climate. It is considered that under normal conditions a high percentage of carbohydrates or starch causes potatoes to be dry or mealy, of protein to be waxy, and of water to be wet and soggy.

Four different methods have been used at our College for determining the quality of potatoes. Chemical analysis furnishes information regarding the amounts of the different constituents; the specific gravity test gives approximately the percentage of starch; the physical examination of the cut potatoes shows the appearance of the tubers and indicates roughly the amount of water, etc., and the cooking test gives the mealiness, the flavor and the appearance of the potatoes for domestic use. Of the four methods, the last mentioned is by far the most satisfactory in determining the real value of the potatoes for eating. If unpeeled potatoes are cooked by steam their table qualities are revealed in a manner which is both practical and convincing. Special attention to the table quality of potatoes will be given in this bulletin.

An average crop of potatoes removes less fertilizing constituents from the soil than does either mangels or corn. In the Province of Ontario an average yield of potatoes removes from an acre of land approximately twenty-five pounds of nitrogen, thirty-seven pounds of potash and eight pounds of phosphoric acid.

The chief use of the potatoes grown in the Province of Ontario is for the production of human food. Raw potatoes lose about twenty per cent. of their weight when peeled. The amount which is fed to farm stock in most seasons is confined largely to the peelings, the culls, and the surplus of old potatoes on hand in the summer when the new crop is ready for use. When the yield per acre is large, and the price per bushel is low, a much larger proportion is used for feeding to farm stock. As the results of experiments in feeding hogs, Fjord of Denmark found that 400 pounds of cooked potatoes equalled 100 pounds of mixed grain; Henry of Wisconsin, that 442 pounds of cooked potatoes equalled 100 pounds of corn meal; and Potter of Oregon, that 360 pounds of steamed or 552 pounds of raw potatoes were equal to 100 pounds of barley. As time advances it is probable



Transverse and Longitudinal Sections of a Potato: 1, Eye; 2, Skin; 3, Cortical or Cambium Layer; 4, External Medullary Layer; 5, Internal Medullary Layer, pith or water-core.

A good potato has a wide Cortical Layer and a narrow or small Internal Medullary area; and a poor potato has a narrow Cortical Layer and a comparatively large amount of pith.

that potatoes may be used somewhat more extensively in Ontario than at present for the manufacture of such products as starch, potato flour, commercial glucose, evaporated potatoes, etc. Bulletin No. 47, of the United States Department of Agriculture, printed November, 1913, refers to the potato crop of Germany as follows: "Forty per cent. are fed to stock, twenty-eight per cent. are used for table purposes, twelve per cent. for seed, six per cent. for alcohol, four per cent. for starch and related products, and ten per cent. decay."

DISTRIBUTION.

We have used the statistical reports of the United States Department of Agriculture as the basis for working out the following interesting information. For the five years previous to the war in Europe, from 1909 to 1913 inclusive, the average of the world's annual production of potatoes amounted to practically five and one-half billion (5,500,000,000) bushels. It is interesting to note that this annual production was contributed by the different continents in the following order:

Europe	89.5%
North America	8.0%
Asia	1.1%
South America	.9%
Australasia	.4%
Africa	.1%

Although the potato originated in America nearly ninety per cent. of the world's production is now grown in Europe, and less than nine per cent. in North and South America combined. Of the five years referred to the lowest production was made in 1911, and the highest in 1913, the difference being practically one billion bushels.

For the same five-year period those countries of the world which made the highest average annual production of potatoes were as follows:

Germany	31.3%
Russia	**23.9%**
Austria-Hungary	12.3%
France	9.0%
United States	6.6
Great Britain and Ireland	**4.7%**
Holland	2.1%
Belgium	2.0%
Spain	1.7%
Canada	1.5%
Sweden	1.2%
Italy	1.1%

For the period referred to which closed with the year 1913 practically eighty-six per cent. of the potatoes of the world were produced in those countries which are now at war, the amounts being about equal for the countries of the opposing forces. The average yield of potatoes per annum for the United Kingdom amounted to 254,438,200 bushels, and for Ireland alone 119,874,000 bushels. Ireland, therefore, produced nearly one-half of the potato crop of the United Kingdom, and 2.2 per cent. of the potato crop of the world.

It is interesting to consider the potato production in its relation to the population of the different countries. Determinations have been made showing the number of bushels per capita in some of the principal potato growing countries of the world. For these determinations the average yields of potatoes for the five years, from 1909 to 1913 inclusive, have been used in connection with the populations of the different countries for about the same dates. The following tabulated results show in order the countries, and the average number of bushels produced yearly for each inhabitant:

Ireland	26.0	Canada	10.8
Germany	25.8	Norway	10.4
Holland	18.9	Russia	7.8
Belgium	14.4	Scotland	7.3
Austria-Hungary	12.9	Spain	4.7
France	12.2	United States	3.9
Sweden	11.8	England	2.7
Denmark	11.7	Italy	1.8
Switzerland	11.5	Servia	.5

It will be seen that although Ireland produced only 2.2 per cent. of the potatoes of the world she grew a greater quantity per capita than any of the other countries under consideration. The potatoes of Ireland form an exceedingly important part of the crop production of that country.

For the five-year period closing with 1914 the potato production of the United States was contributed most largely by the States of New York, 10.6 per cent.; Michigan, 10 per cent.; Wisconsin, 9 per cent.; Maine, 7.4 per cent.; Minnesota, 7.2 per cent.; Pennsylvania, 6.9 per cent.; and Ohio, 4 per cent. These seven States furnished more than one-half of the potatoes produced in the American Union. It will be observed that the States here referred to are all in close proximity to Canada, and that six of them are very near neighbors of Ontario. The average yearly production in the United States for the five-year period was practically four hundred and sixty million (460,000,000) bushels.

For the years from 1910 to 1914 inclusive, the average annual potato production of Canada was 75,189,776 bushels according to the Census report of the Dominion. The greatest production was in 1914 with over eighty-five million, and the lowest in 1910 with less than fifty-six million bushels. There was a decided increase in potato production in 1914 over 1910 in each of the Provinces, as well as in the Dominion as a whole. The average potato production in bushels for the five-year period for each of the Provinces of the Dominion was as follows:

Ontario	19,981,074	P. E. Island	5,909,905
Quebec	17,914,134	Saskatchewan	4,840,468
New Brunswick	8,555,054	Manitoba	4,565,968
Nova Scotia	6,240,751	Alberta	4,144,580
British Columbia	3,037,842		

It will, therefore, be seen that over one-quarter of the potatoes of Canada were produced in Ontario. The production of potatoes in Ontario was about equal to the combined production of potatoes in the three Maritime Provinces, and somewhat greater than the combined production of the potatoes in the four Western Provinces.

Potatoes are grown in every county of Ontario. According to the reports of the Ontario Bureau of Industries those counties of the Province which produced an annual average of upwards of one-half million bushels for the period from 1910 to 1914 inclusive, were as follows:

Simcoe	1.133,900	Wellington	684,383
Middlesex	904,283	Huron	620,935
York	860,127	Bruce	570,631
Grey	797,545	Ontario	528,919
Carleton	781,868	Wentworth	514,960
Hastings	696,858	Renfrew	508,869
Dufferin	503,297		

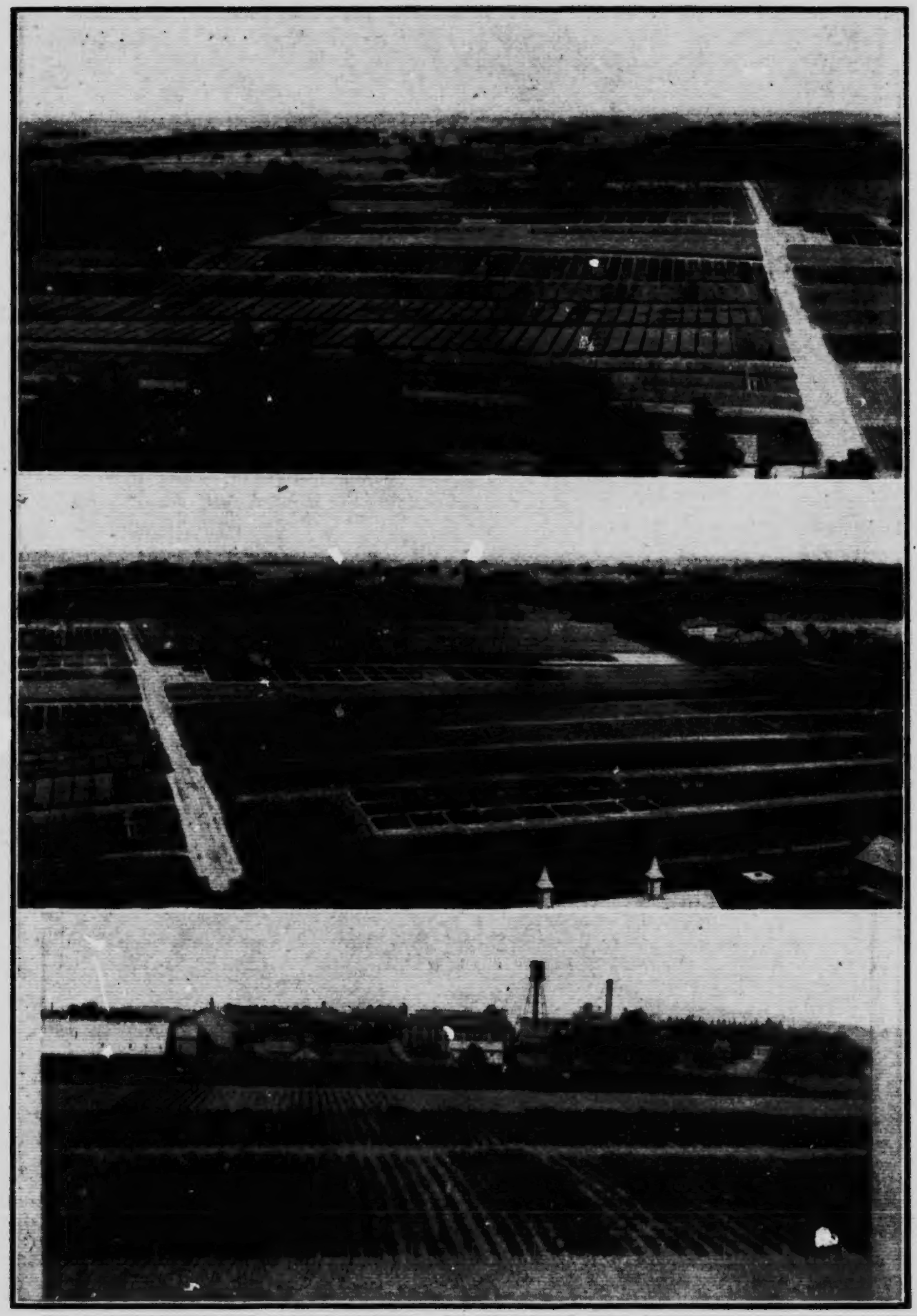
Within the five-year period upwards of one million bushels were produced in three separate years by Simcoe County, and in one year by each of the Counties of Middlesex, York, Grey and Carleton. Those counties of the Province which produced the largest quantities of potatoes represent the western, central and eastern portions of Old Ontario. Many parts of New Ontario, also, are well suited to potato growing but the production is still small in comparison with that of some of the older counties.

According to the census of the Dominion of Canada those townships which were highest in potato production were in the following order: in 1891, Erin, Wellington County; Gloucester, Russell and Osgoode, Russell County; Garafraxa, Wellington County; and Nepean, Carleton County; and in 1911, Gloucester, Russell County; Caradoc, Middlesex County; Vaughan, York County; Caledon, Peel County; Mono, Dufferin County; Erin, Wellington County; and Osgoode, Russell County. Unfortunately, the crop production was not taken by townships in the census of 1901, and consequently, the results for that year cannot be presented.

VALUE OF EXPERIMENTS.

For accurate, specific information of comparative methods of potato growing the growers must depend largely on the experiments and the investigations of the Agricultural Colleges and the Experiment Stations. These institutions are in a position to do work which it would be practically impossible for private farmers to carry out. Comprehensive, systematic experiments in the field and in the laboratory are necessarily expensive and are beyond the means of the individual farmers. In many instances, however, the growers can work in a definite and a systematic way with the Experiment Stations in conducting co-operative tests on individual farms. Such a scheme can be made to furnish important results not only for the experimenters themselves but also for the farmers generally. One of the encouraging features of our day is the knowledge that men are introducing system into their schemes for improvement, and have found that by careful experimenting, in accordance with an orderly plan they can make much more rapid progress, and avoid many disheartening failures.

At the Ontario Agricultural College about forty distinct experiments with potatoes have been conducted in field plots. Each of these experiments has extended over a period varying from five to twenty-six years. As supplementary to the work at the College an average of about 1,600 farmers have conducted annually on their own farms co-operative tests with potatoes. The material and the instructions for this co-operative work have been sent from the College, through the medium of the Ontario Agricultural and Experimental Union. A large number of the farmers of the Province have become very enthusiastic over the co-opera-



Sectional views showing about one-half of the Experimental grounds at the Ontario Agricultural College.

tive experimental work which they have continued from year to year. This experience and this enthusiasm have enabled many to conduct the work with commendable accuracy, and with marked success and to the decided advantage of both themselves and others.

The experimental grounds at the Ontario Agricultural College consist of about seventy-five acres, and are under the control of the Department of Field Husbandry. The grounds are divided into fully two thousand plots, on which experiments are being conducted annually with varieties of potatoes and other farm crops; with artificial, green and barnyard manures; with methods of cultivation, selections of seed and dates of seeding; with treatments for insects and diseases detrimental to the potato; etc.

The plots vary in size according to the requirements of the different experiments, and the yields per acre are determined from the actual yields of the plots in all cases. In the potato tests the general plan is to plant in rows three and one-third links (26⅖ inches) apart with the sets twelve inches apart in the rows. The same distance is allowed between two plots as between two rows of the same plot. In some cases check rows of potatoes are grown between the plots. It will, therefore, be seen that there are no paths left between the plots of potatoes. In most cases a plot consists of three rows each four rods long. Generally the experiments are conducted in two or three places each season. All of the experiments are conducted with the greatest of care and for several years in succession in order to secure results of the highest possible value. An immense amount of thought and care is required in planning, supervising, and examining these plots, and in studying, comparing and summarizing the results for publication.

SOILS.

A portion of the experimental grounds at the College has a gentle slope towards the south, another portion towards the north, and a part of the land is comparatively level. The most of the soil is what might be termed an average clay loam. The bottom lands are tile drained and contain rather more vegetable matter than the higher portions which have a natural drainage. The potato experiments have been rotated over the different sections of the grounds from year to year. Great care has been taken to secure uniformity of soil for all the plots used for each experiment in any season. The grounds are considered to be exceptionally well adapted to experimental work for Ontario.

Potatoes can be grown satisfactorily on almost any fertile and friable soil which is either naturally or artificially well underdrained. Good soils, whether loams, sandy loams, or friable clay loams might be mentioned as particularly well suited for the potato crop. Sandy loams are especially favorable for the production of potatoes for early use. On light sands, heavy clays, and black muck soils the growing of potatoes is usually more difficult, although good results are sometimes obtained from even these soils. The most of the soils of Ontario are very well adapted to potato production providing they are properly underdrained either naturally or artificially. Some sections are particularly well suited to potato growing on a large commercial basis.

ROTATIONS.

The usual four years' rotation in the experimental grounds at the College is as follows: potatoes, grain, pasture and grain. Of the land under rotation the grain plots require one-half, the cultivated crops one-quarter, and the pasture one-quarter each year. The four years' rotation in the Farm Department at the College is potatoes, grain, and two years of clover and grass. A favorite three years' rotation in some sections of the country is potatoes, grain and clover.

A large number of Ontario farmers were written to from the College and asked the following question: "After what crops do you prefer to plant potatoes?" Three hundred and seventy-five answers were received. The crops selected were in the following order: clover, grass, oats, peas, other grains and corn. Clover and alfalfa sods form an excellent preparation for potatoes.

The wise man gives proper attention to the rotation of crops for his farm. The kind of farming, character of soil, proximity to market, amount of labor available, and many other features need to be considered in planning a rotation for the best results. As far as practicable it is a good plan to have each crop in the rotation a helpful preparation for the crop which is to follow. A rotation embodying a cleaning crop, a nurse crop, and a leguminous or fertilizing crop contains features of much importance. Potatoes form one of the best cleaning crops which can be used in a rotation. The thorough cultivation of the potatoes leaves the land in an excellent condition for the crop which is to follow.

Machines for Cutting Potatoes for Planting.
(1) Small machine; (2) Large machine.

CULTIVATION OF SOIL, AND CUTTING AND PLANTING POTATOES.

Many of the questions regarding the cultivation of the soil, the preparation of the seed and the planting of the potatoes will be answered through the results of the experiments which are discussed in this bulletin. It seems necessary, however, to make a few additional notes under the foregoing heading.

Preparation of Soil.—Potatoes do exceptionally well after sod, and especially after clover sod. If fresh stable manure is to be used it is a good plan to plow the land deeply in the early part of the autumn, and at a later date to cultivate the soil and give it a dressing of manure, after which it can be put into ridges about thirty inches wide with a double mould-board plow. This protects the manure and the mellow soil in the ridges and enables the air and the frost to come into direct contact with the subsoil in the furrows. It is the practice of some potato growers to place the manure on the sod in the summer, autumn, winter or spring and to plow the sod with its top dressing of manure before planting time. If potatoes follow corn or roots the fresh manure is often used to advantage with the latter instead of the former. When potatoes come after a grain crop the stubble land is frequently worked on the surface as soon as possible after harvest in order to conserve soil moisture and to induce the weed seeds to germinate. With this preparation the land is in excellent condition to be plowed to a good depth in the autumn even though the weather is comparatively dry. If manure is applied to the land in the spring for the potato crop it should be well rotted and mixed throughout the soil instead of being placed with the seed potatoes in the rows as the manure has the tendency of increasing the scab. The cultivation of the soil for potatoes should be deep and thorough. There are but few crops which respond more readily than potatoes to the careful preparation of the seed bed.

Cutting Seed.—Potato sets should be made compact in form and as even in weight as possible. It is a good practice to take the first set from the stem end, to cut slantingly across the potato, and finally to divide the seed end. The number of sets which a single tuber will furnish depends upon the size of the potato as well as upon the size of the individual sets which are to be made. The number of eyes in each piece has some influence but the comparative size of the sets has a greater influence on crop production. For uniformity in results the potato sets should be nearly equal in weight and should contain about the same number of eyes in the different pieces. Potatoes are usually cut by hand, but there are a number of potato-cutting machines on the market of different styles, sizes and prices.

The following table gives the results of cutting three hundred sets of each of two varieties of potatoes, one hundred with each of two machines, and one hundred by hand:

Number of Eyes per Set.		Potato Sets with Different Number of Eyes.					
		Dooley Variety.			Empire State Variety.		
		Small Machine.	Large Machine.	Hand Cutting.	Small Machine.	Large Machine.	Hand Cutting.
0		12	25	..	..	8	..
½		5	5	..	..	8	..
1		28	31	34	18	25	..
1½		12	6	3	8	13	..
2		13	8	29	13	16	33
2½		8	8	8	10	10	7
3		5	4	21	14	7	23
3½		1	3	1	11	4	2
4		4	2	3	6	..	10
4½		1	1	1	3	1	10
5		6	4	..	9	..	7
5½		1	..	..	..	..	3
6		1	1	..	3	4	2
6½		1	1	..	1	..	..
7		1	..	..	1	..	1
7½		..	..	..	..	1	2
8		..	1	..	2	3	..
9		1	..	..	1	..	..
Total Number		100	100	100	100	100	100
Weight of Sets in Ounces.	10 Largest	18.7	14.0	10.1	20.6	12.3	10.5
	10 Smallest	2.2	8.0	6.3	2.6	1.3	5.4
	1 Largest	2.1	1.8	1.8	2.8	1.4	1.8
	1 Smallest	.2	.2	.6	.2	.1	.5

HAND CUT POTATOES.

MACHINE CUT POTATOES.

White Elephant variety of potatoes cut in different ways.

The results here presented show that in uniformity in the weights of the sets and in the number of eyes per set the hand cutting gave much better results than the machine work. In three out of the four tests from eight to twenty-five per cent. of the sets cut with the machines contained no eyes whatever. It is good economy to take great pains in preparing seed potatoes for planting. The reader is requested to carefully study the results of experiments along this line as presented in this bulletin.

Planting and Cultivation.—Potatoes should be planted with regularity whether the tubers are dropped by hand or by machinery. If the patches are small it is usual to make the furrows with a single or a double mould-board plow, to drop the potatoes by hand and to cover the seed by splitting the ridges with a plow having either a single or a double mould-board. In the experimental work at our College the double mould-board plow is used extensively. When potatoes are grown in large areas machinery is generally used for planting the crop. There are various makes of these machines now sold by manufacturers. The potato planter opens the furrow, drops the sets, covers the seed, and if desirable applies the commercial fertilizer in the one operation. A machine of the Picker type can be operated by one man. Some growers object to this style of machine as it punctures the potatoes and sometimes causes blanks by missing the sets. The platform type of machine is operated by two men, and a full planting can be obtained if the man who fills the sections in the feeding platform is thorough in his work. A good potato planter gives highly satisfactory results.

Soon after planting the field should be lightly harrowed to smooth the surface, to check the germinating weed seeds, and to conserve soil moisture. This process can be repeated just as the young plants are appearing through the ground. As soon as the plants are up the soil between the rows should be cultivated deeply. Other cultivations should follow every week or ten days according to weather conditions, should become more shallow as the season advances, and should be continued until the tops come together between the rows. Thorough cultivation mellows the soil, conserves the moisture, kills the weeds, and greatly assists in the production of large yields of well formed tubers.

CHANGE OF SEED.

The frequent and the indiscriminate change of seed potatoes from one farm to another has been practised by a large number of people in past years. Any reliable information on the perplexed question of the change of seed should be welcome. If it is necessary to change seed potatoes every few years in order to maintain vigor and vitality the work of trying to improve potatoes by hill selection or from seedlings would be discouraging whether conducted at an experiment station or on the individual farms.

Home-grown Seed Potatoes.—At the Ontario Agricultural College five varieties of potatoes have been grown for twenty-six years in succession without any introduction of tubers from an outside source. Care has been taken each year to select from the crop produced good seed potatoes for planting in the experimental grounds in the following spring. No hill selection has taken place in any year in connection with this experiment. The fertility of the soil has probably remained about uniform as in the four years' rotation in which the potatoes were grown, three [illegible] crops were removed from the land, barnyard manure was used once, and no commercial fertilizers were applied.

The results of the experiments are both interesting and suggestive. Starting with 1890, the first year of the experiment, the average yields per acre per annum for the five varieties for the five-year periods were as follows:

1890–1894	133.0	bushels.
1895–1899	212.0	"
1900–1904	237.2	"
1905–1909	208.7	"
1910–1914	211.1	"

The average yield for the whole period of twenty-five years was 200.4 and for the last five years 211.1 bushels per acre. The average yields for the second, fourth and fifth periods were comparatively close, the yield for the first period was low, and that for the third was high. In the first period three out of the five seasons were somewhat unfavorable for potato production, and in the third period only in one year was the yield below normal. The average annual yield per acre for the last period was 23 bushels greater than the average of the other four periods. According to the reports of the Ontario Bureau of Industries the average yield of potatoes for the Province for the five-year period, from 1910 to 1914, inclusive, was 125.6 bushels or an annual yield per acre of 85.5 bushels less than that produced from the five varieties grown at the College for the same period, and after having been grown for twenty years previously on the same farm without change of seed. The ten highest average annual yields were produced after the first five-year period of the experiment. The average results of the five varieties show a higher annual yield per acre for the latter as compared with the former thirteen years of the experiment. It is interesting to note that the average yield per acre of the five varieties in 1915 was exactly thirty bushels per acre greater than that of 1890. This increase was made in spite of the fact that the year 1915 was an exceptionally severe one for potato growing in Ontario.

In each of three different years previous to 1900 the five varieties of potatoes were carefully tested for table quality, including mealiness, flavor and appearance. On scoring the table quality of the same varieties and in the same way in the years 1913 and 1914 it was found that the average quality was practically the same, being slightly in favor of the potatoes produced in the later years.

These results show that potatoes have been grown on average clay loam on the one farm for at least twenty-six years without any perceptible decrease in either productiveness or table quality. In fact the tendency seems to have been towards a slight increase rather than towards a decrease in both yield and quality.

Sources of Seed Potatoes.—In each of four years an experiment has been conducted at the College in testing under uniform conditions potatoes obtained from different sources. For instance, eighteen lots of Empire State potatoes were secured from eight different sources, five being in the Province of New Brunswick, and three in Ontario. Seed potatoes grown about one hundred and forty miles north of Guelph in Muskoka district, near the Muskoka Lakes, have given a higher yield per acre than those obtained from any other source in each of the four years of this experiment. Somewhat similar results to those obtained at Guelph have been secured by other experimenters. Seed potatoes grown in Scotland gave excellent results in the experiments conducted on the Experimental Farm of Cambridge University in England. W. T. Macoun of the Central Experimental Farm at Ottawa, has obtained high records from seed potatoes produced at Indian Head, Sask. It is a common practice of some of the potato growers of the warmer climates to purchase their seed potatoes occasionally from a northern district possessing a cooler climate. Some light may be thrown on this subject by the results which are presented under the heading which follows.

Immature Seed Potatoes.—An experiment has been conducted at the College in each of four years in testing the value of immature potatoes for seed purposes. Six varieties of potatoes comprising two each of the early, the medium and the late kinds were planted at intervals of two weeks, from May 31st until July 12th, and tubers of each variety were obtained from each of the four crops and all were planted about the first of June in the following year. The average of the four years' results in bushels per acre per annum from seed potatoes obtained from each of four dates of planting two early, two medium, and two late varieties are as follows:

RESULTS FROM PLANTING MATURE AND IMMATURE SEED POTATOES.

Seed Potatoes obtained from the crops produced from the plantings of the following dates of previous year	Average Percentage Maturity, Sept. 11th.	Early 2 Varieties (8 tests).	Medium 2 Varieties (8 tests).	Late 2 Varieties (8 tests).	Average 6 Varieties (24 tests)
May 31st	57	192.01	191.67	193.44	192.37
June 14th	56	201.36	185.94	197.09	194.80
June 28th.............	55	211.39	184.33	209.80	201.84
July 12th.............	53	221.36	209.20	227.82	219.46

Potatoes produced from immature seed were slightly later in maturing than those produced from seed which was ripe.

Immature potatoes have a special value for seed purposes according to the results of the experiments which we have conducted. The superior value of northern grown potatoes is probably due to the fact that they are produced in a cool, short season and are harvested at an early date and before they are fully matured. The special value of seed potatoes grown at a high elevation could probably be explained in the same way. Somewhat similar results might be obtained in a warmer climate by using the second crop or immature potatoes for seed or by growing the seed potatoes on heavy damp land, in the shade of trees or under a mulch of from four to six inches of straw or of coarse manure. The results* of experiments conducted in Nebraska have shown that seed potatoes grown under a mulch have compared favorably with seed potatoes obtained from a more northerly district. It should be remembered that a potato is an underground stem and not a seed. The study of immature potatoes for crop production has an important bearing on potato growing and particularly so in the warmer climates.

Small potatoes can be divided into the following three classes: (1) the best tubers from choice seed planted late; (2) the late-formed tubers from strong, robust plants; and (3) the tubers produced from weak, inferior plants. The tubers from either class one or class two would be likely to produce good yields and those from class three unsatisfactory results. In using small seed tubers taken from potatoes of the general crop there is danger of securing those belonging to the third class.

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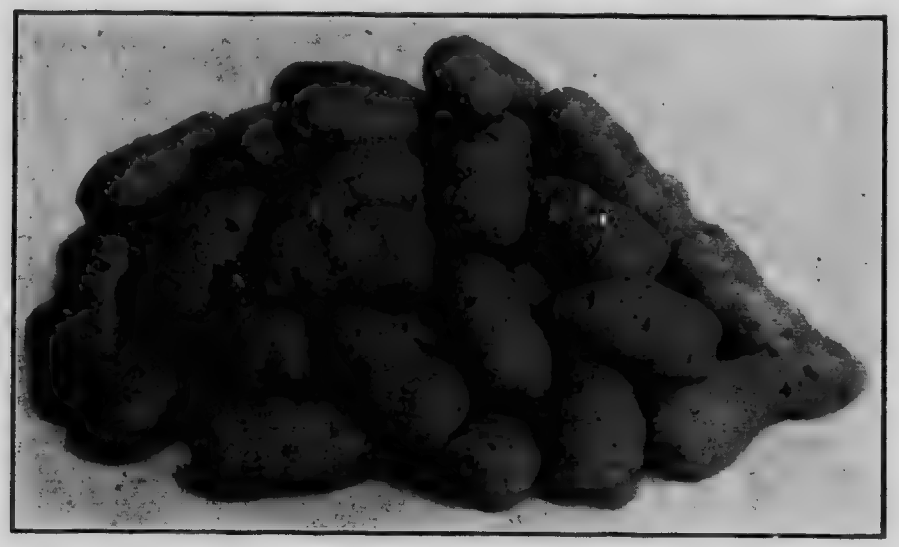
*Mulched potatoes for seed purposes in Eastern Nebraska. Bulletin No. 146, University of Nebraska, 1915.

VARIETIES, AND VARIETY TESTS.

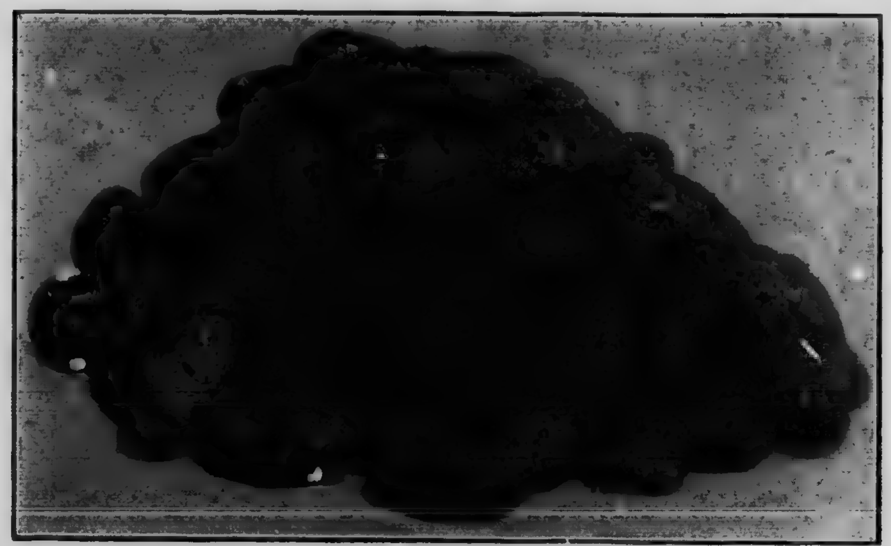
There are far too many varieties of potatoes grown on the farms of Ontario. This is one of the greatest weaknesses in the potato industry of the Province. It is a defect which should be remedied as soon as possible. If Ontario would confine herself to a few of the best varieties of potatoes the annual crop would be increased in yield, in quality, and in commercial value. Owing to the comparative ease with which new varieties are originated from potato seed the number of named sorts has become very large. Seed agents, seedsmen, and growers are constantly introducing new kinds before their relative worth for the Province has been properly determined by comparative experiments. Many of the new kinds are introduced by advertising literature and by travelling salesmen representing American seed firms. Agents go from house to house and sell small quantities of potatoes at high prices. These are usually grown locally to a limited extent. There is scarcely a locality that does not grow several varieties which makes it very difficult to furnish car lots of uniform potatoes.



Potatoes of the Empire State variety

In 1914, thirty-five Agricultural Societies, in eighteen counties and districts of Ontario, used potatoes for the Field Crop Competitions. The number of fields of potatoes entered in the separate Societies varied from ten to twenty-five. There were in all four hundred and fifty-four (454) entries, or an average of thirteen for each Society. No restriction was placed on the number of varieties entered. The reports show that there were over one hundred named varieties of potatoes entered in the Field Crop Competitions in the one season. Of this number sixty-eight varieties received prizes, fifty-two varieties were entered only once, nine varieties ten or more times, and three varieties over thirty times. The number of varieties in the separate competitions varied from three to thirteen. The societies which had less than five varieties in the competition were Caradoc and Strathroy, Middlesex County, each 3; Rainy River Valley, Rainy River district, 3; Verner, Nipissing district, 3; Trafalgar, Halton County, 4; and Rocklyn, Grey County, 4. Those societies which entered the greatest number of varieties were Oliver, Thunder Bay district, 13; South Muskoka, Muskoka district, 11; Stephenson and Watt, Muskoka district, 11; Parry Sound, Parry Sound district, 10, and Armour, Ryerson and Burk's Falls, Parry Sound district, 10.

Potatoes of the Davies' Warrior variety. This lot of potatoes took the Championship Prize in a competition of all the different lots of potatoes shown in the regular classes at the Provincial Winter Fair held in Guelph in December, 1915.



Potatoes of the Early Rose variety.

These facts show the real necessity of testing a large number of the different varieties of potatoes under uniform conditions in order to compare the relative merits of the various kinds. This has been done with great care at the Ontario

Agricultural College. The results are of high value as a general guide and should result in the elimination of many of the varieties now grown in Ontario.

Over four hundred named varieties of potatoes have been under experiment at the College. Nearly all of these have been grown for at least five, and some for fifteen, twenty, or even twenty-six years. After five years' trial the poorer varieties are dropped and the better ones are continued in the experiment. New varieties are added from year to year. In the variety tests good seed potatoes are used for planting each year, but there is no hill selection. A four years' rotation consisting of potatoes, grain, pasture and grain is used. The land for the potatoes is plowed in the autumn. No commercial fertilizers are applied in the variety tests but the land is given a dressing of twenty tons (about twelve loads) of farmyard manure per acre each four years. When practicable the manure is spread on the plowed land in the autumn and the soil is placed into thirty-inch ridges with a double mould-board plow. The land is cultivated in the spring and the manure thoroughly mixed with the soil, and the varieties of potatoes are planted the latter part of May in rows three and one-third links (26⅖ inches) apart. Fifteen pounds of each variety of potatoes are cut into one hundred and ninety-eight (198) pieces which are planted one foot apart in three rows each four rods long. After planting is done the surface soil is kept stirred with a harrow or a weeder until the potatoes are nicely up. A scuffler is used between the rows and level cultivation is followed. Paris green or commercial lead arsenate and Bordeaux mixture are used for spraying the vines three or four times each year. Careful notes are kept of the varieties when growing and when ripening. The potatoes after being harvested are sorted, weighed and carefully examined.

The table quality of the varieties under test is determined in the autumn, the winter, or in the early spring, and usually every second year. This feature of the work has received the special attention we believe its importance demands. For information regarding the method adopted in determining the table quality of the varieties of potatoes the reader is referred to the special section of this bulletin under the title "Table Quality of Potatoes."

Both the yields of the total crop and of the marketable potatoes are determined each season. Those are classed as marketable which are at least one and one-half inches in diameter as determined by a machine for sorting potatoes.

The table here presented gives the average results for **five successive years** of each of one hundred and sixty-four varieties of potatoes grown in the experimental grounds at the College.

CHARACTERISTICS, YIELDS AND TABLE QUALITIES OF 164 VARIETIES OF POTATOES GROWN FOR FIVE YEARS IN SUCCESSION.

Varieties.	Maturity.	Color.	Table Quality (Average 2 Years.)				Bushels per Acre. (Average 5 yrs.) Bushel, 60 lbs.	
			Mealiness 40 points.	Flavor 40 points.	Appearance 20 points.	Total 100 points.	Marketable.	Total.
1. Empire State	Late	White	[illegible]	33.5	15.5	83.0	201.7	224.2
2. Rose's New Invincible	Late	Dull white	30.5	25.5	14.0	70.0	196.2	219.2
3. American Wonder	Late	White	33.0	29.5	14.5	77.0	190.3	217.4
4. Rural New Yorker No. 2	Late	White	29.5	28.0	15.0	72.5	200.4	216.0
5. Pearl of Savoy	Late	Dull white	34.5	31.0	15.5	81.0	189.1	214.1
6. Morning Star	Late	White	31.0	31.4	14.5	76.5	181.9	213.0
7. Governor Foraker	Late	White	32.0	30.0	15.0	77.0	154.0	211.3
8. Silver King	Medium	White	29.5	30.0	15.0	74.5	167.8	210.7
9. Early Rose	Medium	Rose	33.0	30.0	14.0	77.0	179.5	209.0
10. Green Mountain	Late	White	27.0	27.0	15.5	69.5	189.6	208.9
11. Irish Daisy	Late	White	29.5	31.0	14.5	75.0	165.6	208.7
12. Dempsey's Seedling	Late	Dull white	35.0	33.5	16.5	85.0	171.8	208.3
13. White Elephant	Late	White and rose	32.0	30.0	14.5	76.5	184.1	208.3
14. Early May Flower	Medium	White	30.0	28.5	14.5	73.0	171.6	207.3
15. Dakota Red	Late	Red	26.0	27.5	14 5	68.0	184.8	206.0
16. Late Rose	Medium	Rose	31.5	33.5	14.5	79.5	165.7	205.6
17. Alexander's Prolific	Late	White	29.0	28.0	15.5	72.5	183.7	205.1
18. Woodbury White	Late	White	31.5	30.0	14.0	75.5	175.1	205.1
19. Burnaby Mammoth	Late	White and rose	33.5	31.0	15.5	80.0	170.8	204.0
20. Burpee's Superior	Late	White	30.5	29.0	14.0	73.5	172.2	204.0
21. Columbus	Late	White and rose	32.0	27.5	15.5	75.0	176.5	203.6
22. Sweet St. Vernal	Late	White	30.0	28.5	15.0	73.5	169.2	203.3
23. Island McDonald	Medium	White	26.0	27.0	14.0	67.0	166.0	202.7
24. Great Divide	Late	White	32.0	31.5	15.5	79.0	152.7	202.3
25. Wilson's First Choice	Late	White	29.5	29.0	15.5	74.4	170.5	202.2
26. The Ideal	Early	White and rose	28.5	28.5	13.5	70.5	160.6	201.7
27. Farmers' Alliance	Medium	Dull white	31.0	31.0	14.5	76.5	158.5	201.8
28. Bill Nye	Late	White	31.0	26.0	15.5	72.5	167.8	201.2
29. State of Maine	Late	White	29.0	27.5	14.0	70.5	182.4	200.5
30. New Queen	Very late	Nearly white	33.0	31.0	15.5	79.5	174.9	200.3
31. The Daisy	Medium	White and rose	34.0	34.0	15.0	83.0	167.8	200.3
32. Thunderbolt	Medium	White	29.0	26.5	15.5	71.0	179.7	200.3
33. Halo of Dakota	Medium	Nearly white	32.0	32.0	15.0	79.0	160.0	200.0
34. Hotel Favorite	Medium	White	30.5	35.5	16.0	82.0	164.5	199.8
35. St. Patrick	Medium	White	32.5	30.5	14.5	77.0	166.7	199.5
36. Troy Seedling	Very late	White	27.0	25.0	13.0	65.0	149.0	199.0
37. Early Oxford	Medium	Rose	31.5	28.5	14.0	74.0	159.7	198.4
38. Pride of the West	Late	White and rose	28.5	27.0	14.5	70.0	165.1	197.8
39. Delaware	Late	White	29.0	28.5	15.0	72.5	178.0	197.7
40. Watson's Seedling	Medium	Rose	31.5	29.5	13.0	74.0	160.6	197.4
41. Garnets	Medium	Rose	31.0	30.0	14.5	75.5	160.3	197.2
42. Rural Blush	Very late	Rose	32.5	34.5	14.5	81.5	170.7	197.1
43. Badger State	Medium	White	24.5	29.5	15.0	69.0	165.3	196.8
44. Early Yorker	Late	Dull white	34.0	33.0	15.5	82.5	167.8	196.2
45. Early Harvest	Early	White	30.5	32.5	13.5	76.5	145.6	196.1
46. Burbank's Seedling	Medium	White	30.0	34.0	17.5	81.5	164.0	195.6
47. Fillbasket	Late	Dull white	32.0	29.5	15.0	76.5	165.8	195.5
48. June Eating	Late	White	31.5	29.0	14.0	74.5	170.7	195.3
49. Crown Jewel	Early	White	31.0	30.5	14.5	76.0	156.2	194.8
50. Clark's Nonsuch	Medium	Dull white	31.5	31.0	14.5	77.0	170.0	194.4
51. Bruce's White Beauty	Medium	White	31.0	31.5	14.5	77.0	157.1	193.7
52. Adirondack	Late	White	30.5	31.0	15.0	76.5	174.9	193.3
53. Ohio Junior	Early	Rose	26.5	28.0	13.5	68.0	177.3	192.8
54. Scotch Regent	Late	White	29.5	2[illegible]	[illegible]	[illegible]5	158.0	192.6
55. Rochester Rose	Late	Rose	27.5	2[illegible]	[illegible]	[illegible].0	156.1	192.0
56. Advance	Medium	White and rose	29.5	2[illegible]	12.5	[illegible].5	154.3	191.7

CHARACTERISTICS, YIELDS, TABLE QUALITIES, ETC.—*Continued.*

Varieties.	Maturity.	Color.	Table Quality (Average 2 Years.)				Bushels per Acre. (Aver'ge 5yrs.) Bushel, 60 lbs.	
			Mealiness 40 points.	Flavor 40 points.	Appearance 20 points.	Total 100 points.	Marketable.	Total.
57. Summit	Medium	Rose	29.0	29.0	13.5	71.5	157.6	191.4
58. The Dandy	Medium	White	30.5	29.0	14.5	74.0	149.4	190.4
59. Montana Wonder	Late	White	30.0	27.5	15.5	73.0	153.0	190.3
60. Vick's Perfection	Early	White	30.5	28.0	14.0	72.5	150.9	190.3
61. Manitoba Rose	Late	Rose	28.0	27.5	14.5	70.0	163.1	190.2
62. Hoffman	Medium	Rose	32.5	30.5	14.0	77.0	151.5	188.8
63. Early Puritan	Medium	White	30.5	32.5	14.5	77.5	161.8	188.7
64. Red Australian	Medium	Rose	26.5	28.5	14.5	69.5	158.0	188.6
65. Extra Early Vermont	Medium	Rose	33.5	32.5	15.0	81.0	142.1	188.5
66. Munroe Co. Prize	Medium	White	28.0	27.0	14.5	69.5	154.2	188.5
67. Halton's Seedling	Early	Rose	29.5	28.5	13.5	71.5	150.0	188.3
68. Timpe's No. 4	Late	White	27.5	29.5	15.0	72.0	154.8	188.0
69. Hartzell's Seedling	Late	White	30.5	29.5	15.0	75.0	165.3	187.6
70. Everitt's Seedling	Medium	Rose	30.0	29.0	14.0	73.0	146.9	187.3
71. Tonhocks	Early	Dull white	31.0	29.0	15.0	75.0	154.3	187.3
72. Early Everitt	Medium	Rose	30.0	29.0	14.0	73.0	154.6	186.8
73. Granger	Medium	White	27.5	28.0	14.0	69.5	153.8	186.5
74. Russel's Seedling	Late	Dull white	29.0	27.5	14.0	70.5	160.0	186.3
75. Burpee's Extra Early	Early	White and rose	31.5	29.5	14.5	75.5	141.7	185.9
76. Kaiser	Late	White	23.5	26.0	13.5	63.9	169.9	185.8
77. Restaurant	Late	Dull white	26.5	25.0	14.5	66.0	160.3	185.5
78. White Lily	Late	White	30.0	28.0	15.0	73.0	155.9	185.3
79. Reed's Eighty-Six	Medium	Rose	31.0	30.5	13.5	75.0	140.9	185.2
80. Snowdrop	Late	Dull white	32.0	32.0	15.0	79.0	151.5	184.8
81. Grand Mogul	Very late	White	25.0	26.5	14.0	65.5	163.5	184.7
82. May's Imperial	Early	Dull white	31.0	27.0	13.5	71.5	159.8	184.7
83. Nebula	Medium	Rose	31.5	28.5	14.0	74.0	133.9	184.7
84. Molly Stark	Medium	Dull white	35.0	32.5	14.5	82.0	153.8	184.2
85. Paris Rose	Early	Rose	31.0	29.5	14.0	78.5	136.1	183.3
86. Polaris	Early	Dull white	31.5	31.0	14.0	76.5	148.3	183.3
87. Vick's Champion	Medium	White	26.0	26.5	14.0	66.5	161.0	183.3
88. Thorburn's Extra Early	Early	Rose	34.5	32.5	14.5	81.5	138.7	181.8
89. Arizona	Medium	Rose	30.0	26.0	13.0	69.0	147.9	181.3
90. Hopeful	Medium	White	31.5	30.5	16.5	78.5	161.4	180.0
91. Early Pride	Early	Rose	30.5	30.5	14.5	75.5	123.8	180.0
92. Mount Carbon	Medium	White	26.5	26.0	14.5	67.0	159.3	180.0
93. The Freeman	Medium	White	30.5	31.0	15.5	77.0	125.7	179.0
94. King of the Roses	Early	Rose	28.5	29.0	13.5	71.0	142.1	178.9
95. Snow Queen	Medium	White	29.0	28.0	14.5	71.5	139.7	178.9
96. Early Sunrise	Early	White and rose	32.5	30.5	14.5	77.5	142.1	178.8
97. Rosy Morn	Early	Rose	33.0	32.0	14.5	79.5	152.6	178.2
98. Early Maine	Medium	Rose	31.5	30.0	14.0	75.5	139.2	178.1
99. Steele's Earliest	Early	Nearly white	30.0	29.0	13.0	72.0	123.7	178.1
100. Pootaluck	Medium	Rose	29.5	30.5	12.5	72.5	138.6	178.0
101. Early White Prize	Early	Dull white	32.5	30.5	15.0	78.0	134.0	177.8
102. Putnam	Late	White	25.5	22.0	13.0	60.5	148.3	177.8
103. Great West	Late	White	30.0	29.0	15.5	74.5	153.7	177.2
104. Mammoth Pearl	Late	White	27.0	26.0	14.0	67.0	157.[illegible]	176.8
105. Sunlit Star	Early	Rose	32.5	31.5	16.0	80.0	141.8	176.8
106. Stray Beauty	Very early	Red	19.5	19.0	13.0	51.5	147.9	176.5
107. Pride of the Table	Late	Rose	30.0	28.0	15.0	73.0	147.7	176.0
108. Early Dominion	Very early	Dull white	31.5	29.0	14.5	75.0	159.3	175.9
109. McIntyre	Late	Nearly white	32.0	31.5	15.0	78.5	143.8	175.8
110. Minister	Very late	White	28.5	27.5	15.0	71.0	158.5	174.6
111. Kosh Konong	Medium	White	24.0	22.0	13.0	59.5	153.7	174.3
112. Vaughan	Early	White and rose	32.5	30.5	15.0	78.0	137.0	174.2
113. Parson's Prolific	Late	White	26.5	27.0	15.0	68.5	152.3	174.2
114. General Gordon	Late	Rose	28.5	29.5	16.0	74.0	151.0	174.1

CHARACTERISTICS, YIELDS, TABLE QUALITIES, ETC.—*Continued.*

Varieties.	Maturity.	Color.	Table Quality (Average 2 Years.) Mealiness 40 points.	Flavor 40 points.	Appearance 20 points.	Total 100 points.	Bushels per Acre. (Aver'ge 5 yrs.) Bushel, 60 lbs. Marketable.	Total.
115. Van Orman's Earliest	Early	White	26.0	23.5	15.0	64.5	137.1	173.0
116. Golden Harvest	Medium	Rose	32.0	29.5	15.0	76.5	127.3	172.6
117. Early Pontiac	Early	White	28.5	28.0	13.0	69.5	128.4	172.5
118. Clay Rose	Late	Rose	23.5	29.0	15.0	67.5	140.5	171.4
119. Pride of the Market	Late	White	28.5	28.5	15.0	72.0	139.7	171.1
120. Boley's Northern Spy	Early	Rose	30.5	28.5	14.0	73.0	155.4	170.0
121. Chas. Downing	Very early	White	30.0	32.0	15.0	77.0	101.4	169.6
122. Improved Rose	Late	Rose	34.0	31.5	15.0	80.5	139.0	169.3
123. Salzer's Prize Taker	Medium	Rose	29.0	28.0	13.5	70.5	131.6	169.1
124. Ontario	Late	Dull white	30.0	29.5	14.5	74.0	137.4	167.0
125. Howe's Premium	Very early	White and rose	22.0	25.5	13.5	61.0	148.1	166.3
126. The Rosedale	Medium	Rose	31.0	30.0	15.0	76.0	130.1	166.1
127. Six Weeks	Very early	Rose	30.5	28.5	14.5	73.5	146.5	165.3
128. Chicago Market	Medium	Rose	29.5	29.0	14.5	73.0	132.5	164.5
129. White Star	Late	White	32.5	30.5	15.5	78.5	144.6	164.4
130. Early Northern	Medium	Nearly white	31.0	29.5	14.0	74.5	123.2	164.2
131. Rot Proof	Late	Rose	29.0	26.5	13.0	68.5	104.8	163.7
132. Vick's White Gem	Medium	White	30.5	30.5	14.5	75.5	118.5	163.0
133. Early Essex	Medium	Rose	31.0	29.5	13.5	74.0	123.8	162.9
134. Pride of Ireland	Medium	White	25.5	25.0	13.5	64.0	143.9	162.5
135. …tor Rose	Late	Rose	32.0	31.0	14.0	77.0	137.9	162.1
136. Beauty of Beauties	Medium	White	24.0	24.0	14.0	62.0	141.5	161.3
137. The People's	Late	White	23.0	22.0	13.5	58.5	141.7	161.2
138. Early Market	Early	White and rose	27.5	27.0	13.0	67.5	139.1	160.9
139. Lee's Favorite	Early	Rose	30.5	29.5	13.5	73.5	115.4	160.8
140. New Satisfaction	Medium	Dull white	30.5	30.5	15.5	76.5	119.6	160.1
141. Snowflake	Very early	White	29.5	30.5	14.5	74.5	92.3	159.2
142. Early Advancer	Early	Dull white	29.0	28.0	13.5	70.5	111.3	158.0
143. North Pole	Very early	Dull white	30.5	28.0	14.5	73.0	11[illegible].8	157.0
144. Harbinger	Medium	White and rose	30.0	27.5	15.5	73.0	97.3	155.8
145. Governor Rusk	Very late	Rose	31.0	31.0	15.0	77.0	112.8	155.3
146. Rose of Erin	Late	Rose	26.0	24.5	14.5	65.0	131.[illegible]	154.6
147. Rose Seedling	Medium	Rose	25.5	26.5	16.0	68.0	135.[illegible]	154.0
148. Negro	Very early	Purple	25.5	22.0	12.5	60.0	68.3	153.5
149. Seneca Beauty	Late	Rose	27.5	27.0	15.5	70.0	136.4	153.3
150. Chatauqua	Late	Rose	29.0	26.0	13.0	68.0	11[illegible].4	152.8
151. Landreth's Garfield	Medium	White	28.0	28.0	14.0	70.0	102.5	152.6
152. Vanguard	Medium	Rose	29.0	30.0	13.0	72.0	108.3	152.1
153. World's Fair	Medium	White	32.0	30.5	15.0	77.5	114.5	151.4
154. Royal Adelaide	Late	Dull White	23.5	26.0	12.0	64.5	124.9	150.0
155. Dreer's Standard	Late	White	30.0	30.5	14.5	75.0	116.3	147.5
156. Maggie Murphy	Late	Rose	32.0	33.0	15.5	80.5	125.8	145.5
157. Michigan Blues	Late	Purple	25.5	24.5	14.5	64.5	122.4	141.5
158. Lady Finger	Medium	White	29.0	37.0	11.5	77.5	42.6	139.8
159. Potentate	Early	White	29.5	29.5	14.5	73.5	125.8	139.5
160. Silver Dollar	Early	White	25.5	16.0	12.5	54.0	104.0	138.3
161. Browell's Seedling	Medium	Rose	27.5	26.5	15.5	69.5	104.0	135.0
162. Prince Albert	Medium	White and rose	27.5	30.0	14.0	71.5	100.8	134.1
163. Columbia Peachblow	Late	White and rose	29.0	32.0	14.5	75.5	83.3	115.7
164. Eyeless	Early	White and rose	27.0	33.0	13.0	73.0	43.9	83.6

The average annual yield of potatoes per acre for the thirty-four years, from 1882 to 1915 inclusive, has been 116 bushels in Ontario, and 85 bushels in the United States; and for the twenty-six years, from 1890 to 1915, practically 200 bushels at the Ontario Agricultural College. In each of the thirty-four years the Ontario yield was greater than the yield of the United States with the exceptions of 1902 and 1915. On the average for the whole period the yield of potatoes in Ontario was greater than that of the United States by fully 36 per cent. The highest annual average yields per acre made in Ontario were 163 bushels in 1884 and 159 bushels in 1895 and in 1914; and in the United States 113 bushels in 1912, and 110 bushels in 1904. The lowest annual average yields per acre made in Ontario were 76 bushels in 1915, and 76.1 bushels in 1887; and in the United States 56 bushels in 1890, and 57 bushels in 1887.

According to the census reports of Canada the average yield of potatoes per annum for the five years, from 1910 to 1914 inclusive, was 158 bushels for the Dominion and 129 bushels for Ontario.

A study of the reports of the Bureau of Industries for Ontario shows that usually the highest yields of potatoes in the Province are produced in the northern and north-eastern sections, and the lowest average yields in the southern portions.

The results in the United States and in Canada here referred to show that the potatoes which were grown in the north gave larger yields per acre than those which were grown farther to the south.

As the average yield of potatoes per acre in Wellington County, in which the Agricultural College is located, has been about equal to the average yield throughout Ontario for the past quarter of a century, the results of the potato experiments conducted at Guelph should form a good general guide for the Province.

The results of the one hundred and sixty-four varieties of potatoes grown in the experimental grounds for a period of five years show an average of 181 bushels per acre per annum. The ten highest yielding varieties gave an average of 215 bushels, and the ten lowest yielding varieties an average of 130 bushels per acre. The two varieties in this extensive test which gave an average yield of over 200 bushels of marketable potatoes per acre were the Empire State and the Rural New Yorker No. 2.

It will be seen that as a general rule somewhat larger yields per acre were produced from the late as compared with the early, and from the white as compared with the colored varieties. Apparently the productiveness was influenced but little owing to the shapes of the potatoes of the different varieties. A popular potato is one of about the following dimensions: Length 3½ inches, width 3 inches, and depth 1½ to 1¾ inches.

There is a decided difference in the table quality of the potatoes of various kinds. Variety is a most important factor in determining the quality of cooked potatoes. The figures given in the tabulated results regarding the table quality of the separate varieties are exceedingly interesting and worthy of careful study. It will be seen that in mealiness there is a variation of from 19.5 to 35 points, in flavor from 19 to 35.5 points, and in appearance from 11.5 to 17.5 points. In table quality the Dempsey's Seedling, the Empire State and the Daisy made the highest scores. The Stray Beauty or Bliss Triumph came comparatively low in table quality. This variety, however, is particularly useful for very early market when it is dug before maturity, at which time it compares more favorably in quality with the other varieties.

The comparative order of merit of the highest ten varieties of potatoes obtained by combining the table quality with the yield of marketable tubers is as follows: Empire State 100.0, Pearl of Savoy 91.4, American Wonder 87.5, Dempsey's Seedling 87.0, Rural New Yorker No. 2, 86.8, White Elephant 84.1, Morning Star 83.2, Rural Blush 83.2, The Daisy 83.0, and New Queen 83.0. In comparison with these the lowest varieties in order of merit were the Negro 24.5, the Lady Finger 19.7, and the Eyeless 19.1.

The potatoes representing all the varieties given in the tabulated list have been carefully examined. Some of them are very similar in growth and in appearance. In each of the following nine groups the varieties were found to correspond closely with one another: Grand Mogul, Sir Walter Raleigh, Carman No. 3, and Minister; Delaware, Green Mountain, and Alexander's Prolific; Carman, Pearl of Savoy, Early Yorker, and Brown's Elephant; Early Everitt and Everitt's Seedling; Pride of Ireland, Kosh Konong, and Beauty of Beauties; Improved Rose and Sunlit Star; Reed's Eighty-Six, Early Maine, and Nebula; Early Puritan and Bruce's White Beauty; Vick's Champion, Mount Carbon and Mammoth Pearl. Although there is a similarity in these varieties it is possible that the history of the various kinds is different.

The following table gives the average results of each of five varieties of potatoes for table quality for **eight years,** and in yield per acre for the last quarter of a century:—

Varieties.	Table Quality Average 8 years. (Maximum 100.)	Bushels per Acre per annum. Average 25 years.
Empire State	83	220
Rose's New Invincible	74	216
Rural New Yorker No. 2	68	204
White Elephant	76	188
Stray Beauty	50	159

The first, third and fourth are late varieties of white potatoes well known in Ontario. The Stray Beauty is also called the Bliss Triumph and Earliest of All, and is a round, red potato which matures early and is used largely for early market.

In an experiment extending over a period of ten years, twenty-eight varieties of potatoes were grown under uniform conditions. Some of these are included in the table already presented. A number of other varieties, however, not included with the former results are here mentioned in addition to two kinds which are again named as a basis of comparison. The average yield of each variety for the ten-year period in bushels of potatoes per acre per annum was as follows: Empire State 242, Holborn Abundance 230, Rural New Yorker No. 2, 225, Beauty of Hebron 216, Rose of the North 209, Sir Walter Raleigh 195, Carman No. 1, 193, Early Fortune 183, and New White Beauty 180.

In another competition of each of twenty-four varieties for eight years the following average yields in bushels per acre per annum are interesting: Davies' Warrior 252.2, Extra Early Eureka 218.0, Empire State 193.0, Early Ohio 182.0, and Early Pinkeye 151.0.

In each of the past two years eighty-eight varieties of potatoes have been grown in our experimental grounds. Some of these were grown in 1914 for the first time. It will be remembered that the season of 1914 was particularly good and that for 1915 was unfavorable for potato growing. We do not put much stress on two years' results, but as some of the varieties have been grown for only that length of time we believe the results will be interesting. Those kinds which gave the highest average yield in bushels per acre per annum for the two-year period are as follows: The Hustler 287.8, Pan American 261.3, Statesman 260.8, Late Faction 260.2, Irish Cobbler 260.0, Sir Walter Raleigh 256.5, and Dooley 254.6. In yield of potatoes per acre the Dooley occupied ninth place in 1914 and eighth place in 1915.

The results of experiments at the College for the past year are of peculiar interest owing to the abnormal weather conditions. One variety, viz., the Snowball, gave a yield of only 13 bushels per acre, and another variety, viz., the Hustler, under similar conditions, gave a yield of 366 bushels per acre. The Extra Early Eureka came third in 1915 with 326 bushels per acre, and second with an average of 232 bushels per acre for the past five years. It has already been shown that in the past eight years the Davies' Warrior stands first with 252, and the Extra Early Eureka second with 218 bushels per acre per annum. In comparing the varieties tested for a longer period of time the Empire State occupies highest place in productiveness. These three varieties, viz., the Empire State, the Davies' Warrior and the Extra Early Eureka have all given high yields per acre in the comparative tests at the College.

At the Provincial Winter Fair, held at Guelph, in each of the past eight years those varieties of potatoes which have been most prominent are the Empire State, in the Late Long White class, and the Rural New Yorker No. 2, the Green Mountain and the Gold Coin in the Late Round White class. In December, 1915, potatoes were entered under three separate organizations at the Provincial Winter Fair at Guelph. Of the Late Round White varieties the Davies' Warrior took first prize in the open class and also first prize in the Canadian Seed Growers' Association class. The Davies' Warrior variety also took first and second prizes for potatoes of any type from the Standing Field Crop Competitions in the Province, and it received the Championship for the best lot of potatoes in any section in any class at the Winter Fair. The following varieties received one first prize each: Empire State, Delaware, Beauty of Hebron, Burpee's Extra Early and Early Rose. The Dooley potatoes had more entries than any other variety and received sixth prize in the open class and fifth prize in the class from the Field Crop Competition. The potatoes were judged by T. G. Raynor, of the Dominion Department of Agriculture.

DESCRIPTION OF EACH OF TEN VARIETIES OF POTATOES.

Although upwards of four hundred varieties of potatoes have been under experiment at the College only a few of these are outstanding in certain important characteristics. Ten varieties which have become prominent in Ontario, or which have made high records in our experimental work have been selected for a somewhat detailed description. It is difficult to describe in words the comparative shapes of the potatoes of the different varieties. In order to get some definite basis of comparison one hundred tubers grown at the College in 1915 of each of ten varieties of potatoes were carefully measured. It should be remembered that these measurements were made for one year only, and of potatoes which were grown in a season which was somewhat abnormal. It is the object in presenting the average results to give the comparative thickness, width and length of potatoes of the different varieties without regard to the comparative size of the tubers. In order to make the results as comparable as possible the thickness of the potato is taken as the unit and is represented in every instance by 1. By taking 1 as the basis of thickness, the width and the length form interesting comparisons.

The following table gives the comparative thickness, width and length of the tubers of each of ten varieties grown in the experimental plots in 1915, the varieties being arranged in order of the comparative length of tubers:—

Varieties.	Thickness.	Width.	Length.
Empire State	1	1.28	2.09
White Elephant	1	1.24	1.81
Green Mountain	1	1.26	1.71
Davies' Warrior	1	1.37	1.62
Rural New Yorker No. 2	1	1.34	1.60
Dooley	1	1.32	1.55
Carman No. 1	1	1.30	1.51
Early Ohio	1	1.20	1.51
Extra Early Eureka	1	1.26	1.37
Stray Beauty	1	1.23	1.30

In addition to the measurements given in the preceding table describing the shape of the tubers of each of ten different varieties, the following information furnishes further particulars:

Empire State.—Originated in 1881 by E. L. Coy, Hebron, N.Y., from seed of White Elephant, and introduced by W. A. Burpee in 1885; variety late in maturing, popular and extensively grown in Ontario; skin, white and smooth; eyes, medium depth; rot resistance, medium; yield, excellent; table quality, superior.

White Elephant.—Originated by E. L. Coy, Hebron, N.Y., and is supposed to be a seedling of Garnet Chili, crossed with White Peach Blow; introduced by J. M. Thorburn & Company in 1881; variety late in maturing, not as popular or as much grown in Ontario now as twenty years ago; skin, nearly white with rose tint; eyes, medium depth; rot resistance, medium; yield, good; table quality, good; said to be closely related to the Beauty of Hebron, which it resembles in appearance.

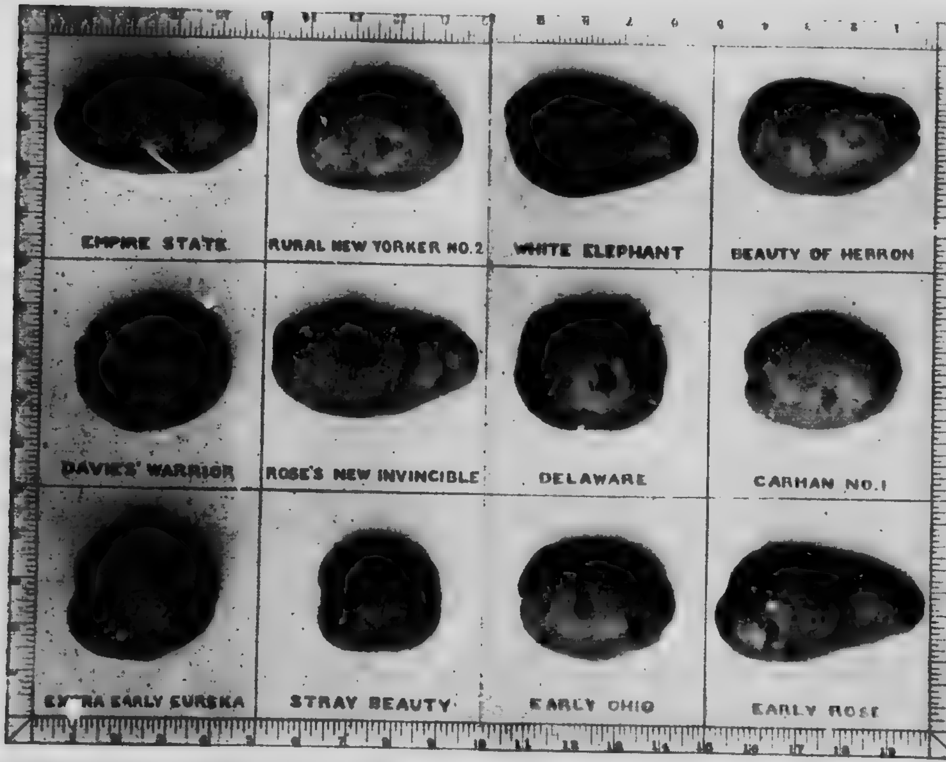
Green Mountain.—Originated in 1878 by O. H. Alexander, Charlotte, Vermont; said to be a seedling from a cross between Excelsior and Dunmore; sold by J. A. Everett & Company in 1885; variety late in maturing, fairly popular and grown extensively in the Maritime Provinces; skin, dull white; eyes, fairly shallow; rot resistance, medium; yield, good; table quality, fair; similar in appearance to Delaware, which is sometimes sold for the Green Mountain.

Davies' Warrior.—Originated in Scotland, and introduced by Wm. Davie & Company about 1899; imported by the Ontario Agricultural College in spring of 1904; increasing in Ontario as its qualities become known; maturity, very late; skin, white; eyes, shallow; rot resistance, best of all the varieties tested at the Ontario Agricultural College in each of five years in which rot was more or less prevalent; yield, one of the highest; table quality, good.

Rural New Yorker No. 2.—Originated from seed selected by Elbert S. Carman, Editor of "The Rural New Yorker," and introduced by the Rural New Yorker Publishing Company in 1888, and by J. M. Thorburn & Company in the year following; late in maturing; popular, and most extensively grown variety in Ontario; skin, white and smooth; eyes, medium shallow; rot resistance, medium; yield, good; table quality, good; tubers large and sometimes hollow.

Dooley.—Originated from one hill of potatoes selected in the field in Waupaca County, Wisconsin, in 1896; introduced by Gunson, Brown & Company in 1900; grown in parts of Middlesex and Wentworth counties, Ontario; medium to late in maturing; skin, white; eyes, fairly shallow; rot resistance, good; yield, good; quality, fair.

Carman No. 1.—Originated in 1889 by Elbert S. Carman as a seedling from a seedling, and sold by J. M. Thorburn & Company in 1894; late in maturing; fairly popular, grown considerably in the Western Provinces; skin, white; eyes, fairly shallow; rot resistance, poor; yield, fair; table quality, fair; tubers sometimes hollow.



Twelve Prominent Varieties of Potatoes grown from eight to twenty-six years in connection with the experiments at Guelph

Early Ohio.—Originated in 1871 by Alfred Reese, and is said to be a seedling of the Early Rose; introduced in 1875 by J. J. H. Gregory; popular as an early variety in Ontario for home and market; skin, rose or flesh color; eyes, comparatively shallow; rot resistance, poor; yield, fair; table quality, good.

Extra Early Eureka.—Originated from one hill of potatoes selected in a field of the Early Morn variety by Geo. R. Pedrick, of New Jersey, in 1895; increasing in Ontario as its qualities become known; maturity, early; skin, white; eyes, medium depth; rot resistance, one of the best; yield, good to excellent; table quality, good in all seasons. In appearance the Extra Early Eureka closely resembles the Irish

Cobbler, but in the tests at the Ontario Agricultural College it has been superior to that variety both in table quality and in rot resistance.

Two Early Varieties of Potatoes grown under uniform conditions. The Extra Early Eureka variety at the right shows strong, vigorous plants, and the Early Ohio variety at the left a more delicate growth.

Stray Beauty, or Bliss Triumph.—Originated in Connecticut, and said to be a seedling of Peerless crossed with a seedling of Early Rose; introduced by B. K. Bliss & Sons in 1878; grown for home use and early market in Ontario to a limited extent, but more extensively in the Eastern States; popular with market gardeners for very early digging; one of the earliest of the four hundred varieties of potatoes tested at the Ontario Agricultural College; skin, red; eyes, rather deep; rot resistance, one of the best; table quality, comparatively good early in the season, but poor in the winter.

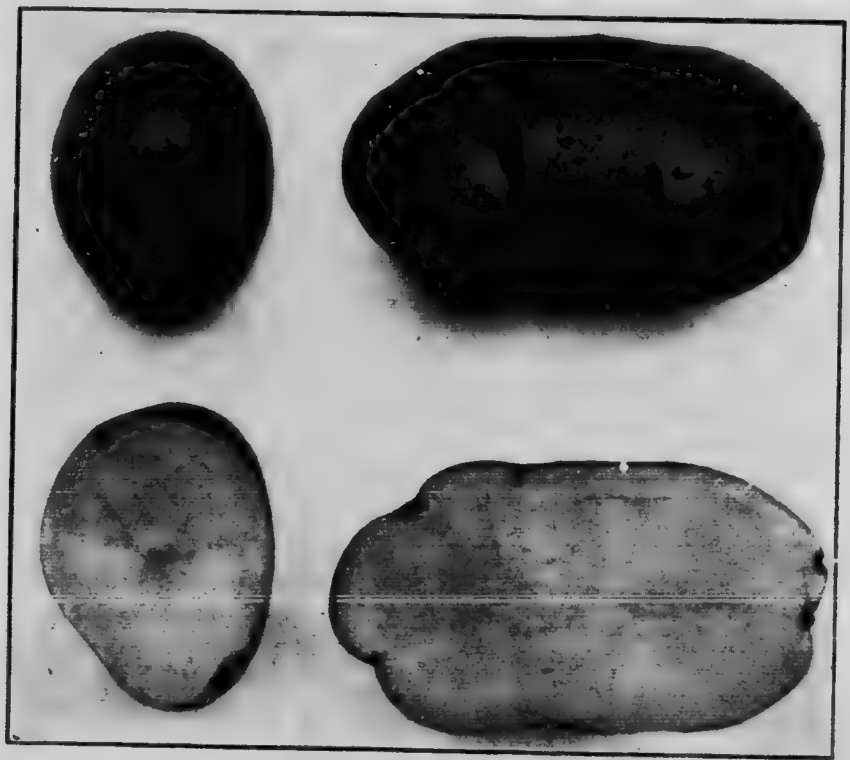
EARLY VARIETIES FOR EARLY USE.

There is much interest taken in early varieties of potatoes whether grown for home use or for early market. Experiments in which all potatoes are allowed to mature before they are harvested do not furnish the best information in regard to comparative value of the different varieties for very early digging. From the general experiments with varieties of potatoes some of the earliest kinds were selected for special tests in regard to their productiveness before being matured. An experiment with this special object in view was conducted for five years in succession by planting six rows of each variety in the spring and digging two rows of each at the end of nine weeks, two rows of each at the end of twelve weeks, and the remaining two rows of each at the end of fifteen weeks after the seed was planted in [illegible] to ascertain which varieties of potatoes would give the best returns in the [illegible]est time after planting.

The following table gives the average results for **five years** in yield of potatoes per acre, and in percentage of potatoes over one inch in diameter for each of the three dates of digging:

Varieties of Early Potatoes.	Percentage of Potatoes over one inch in diameter. Average five years.			Yield of Potatoes per acre. Average five years. (bushels).		
	9 weeks.	12 weeks.	15 weeks.	9 weeks.	12 weeks.	15 weeks.
Stray Beauty	78.2	90.4	93.1	112.5	164.0	184.6
Howe's Premium	81.1	92.8	94.5	103.1	151.4	185.4
Early Ohio	85.2	95.8	95.1	99.8	160.8	173.3
Early Dominion	84.1	95.3	96.5	88.6	159.5	196.6
Burpee's Extra Early	72.9	91.2	94.1	86.2	158.8	175.4
Steele's Earliest of All	68.4	89.9	94.5	85.0	151.6	188.4
Tonhocks	73.3	91.8	95.6	81.2	164.6	216.9
Snowflake	56.6	87.3	92.3	78.1	143.2	172.6
Chas. Downing	57.4	86.7	92.2	77.1	[illegible]	188.0
Early Rose	64.4	91.7	96.0	75.9	155.1	223.9
Early Sunrise	62.3	89.0	95.1	59.0	137.4	177.5

In the table here presented the varieties are arranged in order of yield per acre at the first digging. It will be noticed that the greatest yield per acre was produced by the Stray Beauty at the first, by the Tonhocks at the second, and by the Early Rose at the third digging. The comparative ratio between



Empire State Potatoes.

the first and the third digging is quite marked in the different varieties, as for instance, in yield per acre the first crop as compared with the third was 61 per cent. in the Stray Beauty, and 56 per cent. in the Howe's Premium; and only 34 per cent. in the Early Rose and 33 per cent. in the Early Sunrise. The Early Ohio which stands third in average yield per acre comes highest in percentage of large potatoes as represented in the results of the first digging.

Another experiment with early varieties was conducted in a similar manner as the one already described and was repeated for six years. The second experiment included five varieties not mentioned in the first test. These varieties gave the following number of bushels of marketable potatoes per acre at nine weeks after planting: Early Andes, 160; Six Weeks, 157; Early Fortune, 154; Early Dawn, 152; and Early Pinkeye, 146. In comparison with these the Early Ohio gave 143 bushels per acre.

Four varieties of early potatoes have been under test for early production in each of eleven years. The average yield of potatoes per acre per annum for the whole eleven-year period when harvested at the end of nine weeks was as follows: Early Dominion 126.6; Early Ohio, 126.4; Stray Beauty, 115.7, and Burpee's Extra Early 100.1. When these experiments were started we did not have the Extra Early Eureka or the Irish Cobbler varieties under test, therefore, these varieties were not included in the special experiment with early potatoes.

Davies' Warrior Potatoes.

Taking into consideration the different experiments we have conducted those varieties which are among the most productive for early use are the Stray Beauty or Bliss Triumph, the Early Andes, the Early Dominion, the Howe's Premium and the Early Ohio

CO-OPERATIVE EXPERIMENTS WITH VARIETIES OF POTATOES.

Some of the varieties of potatoes which are now the most extensively grown throughout Ontario were first tested at the College and were afterwards used in the co-operative experiments on different farms over the Province. The Rural New Yorker No. 2, the Empire State, the Davies' Warrior, the American Wonder and the Green Mountain of the late varieties, and the Early Ohio, the Stray Beauty and the Extra Early Eureka of the early varieties have been used in this way. Co-operative experiments with a few of the leading varieties of potatoes have been conducted throughout Ontario annually since 1894. As the Davies' Warrior had made the highest record of the late potatoes and the Extra Early Eureka of the early potatoes previous to 1913 it was decided to confine the co-operative experiments entirely to these two kinds. Full reports of carefully conducted experiments of these two varieties were received from 310 Ontario farmers in 1913, and from 293 farmers in 1914. The average results for the past four years show that the Davies' Warrior gave an increase over the Extra Early Eureka in average yield of potatoes per annum of 25.6 bushels. In the average of the co-operative experiments for 1909, 1911 and 1912 the Extra Early Eureka surpassed the Early Ohio by 41 bushels per acre per annum. In the co-operative experiments conducted in 1911 and in 1912, the Davies' Warrior surpassed the Empire State in yield of potatoes per acre per annum by an average of 36.3 bushels. In the average of experiments successfully conducted in 1908, the Empire State surpassed the Green Mountain variety by an average of 38.7 bushels per acre. During the six years in which the Empire State and the American Wonder

Extra Early Eureka Potatoes.

were tested throughout Ontario the former surpassed the latter in yield of potatoes per acre in each of six out of eight years.

The three varieties of potatoes which have made particularly good records in the co-operative experiments throughout Ontario in yield per acre, table quality, and popularity with the experimenters are the Davies' Warrior and the Empire State of the late varieties, and the Extra Early Eureka of the early kinds. The Davies Warrior does particularly well in some localities and not quite so well in others. As for instance, it did splendidly near Mount Brydges, in Middlesex County, on three different farms on which it was grown for four years, and it did poorly near Strathroy, only five or six miles distant, and where it was tested for a year or two on a couple of farms. In the Acre Profit Competition conducted in 1915 in different counties and with different varieties the Davies' Warrior gave a yield per acre on one farm of five hundred and fourteen bushels, which was the highest in the Province. The Empire State is a fine quality of potato but seems to require more favorable growing conditions than some of the other varieties. The Extra Early Eureka has been popular as a fairly early potato under a variety of conditions. For fuller information regarding the results of the co-operative experiments the reader is referred to the annual reports of the Experimental Union which can be secured from the Department of Agriculture, Parliament Buildings, Toronto.

TABLE QUALITY OF POTATOES.

The table quality of potatoes has been already referred to in connection with results presented in the large table of varieties. As the subject is of so much importance, however, and has been so frequently neglected in comparing different varieties of potatoes it is thought advisable to give particular attention to the question at this time. The table quality of potatoes is influenced to a certain extent by soil, maturity, age of the tubers, varieties, etc. There is a greater variation in table quality of potatoes of different varieties than many people realize. The information presented in this bulletin is most convincing in this respect.

The process of testing the table quality of all the varieties of potatoes at the College in any one year requires from one week to ten days. A potato steamer for cooking fifteen varieties at a time has been specially constructed for the purpose. The potatoes are cooked by steam and without being peeled. By this method there is practically no loss of the constituents of the potatoes. The scale of points used for scoring the cooked potatoes is as follows:

Mealiness	40 points
Flavor	40 points
Appearance	20 points
Total	100 points

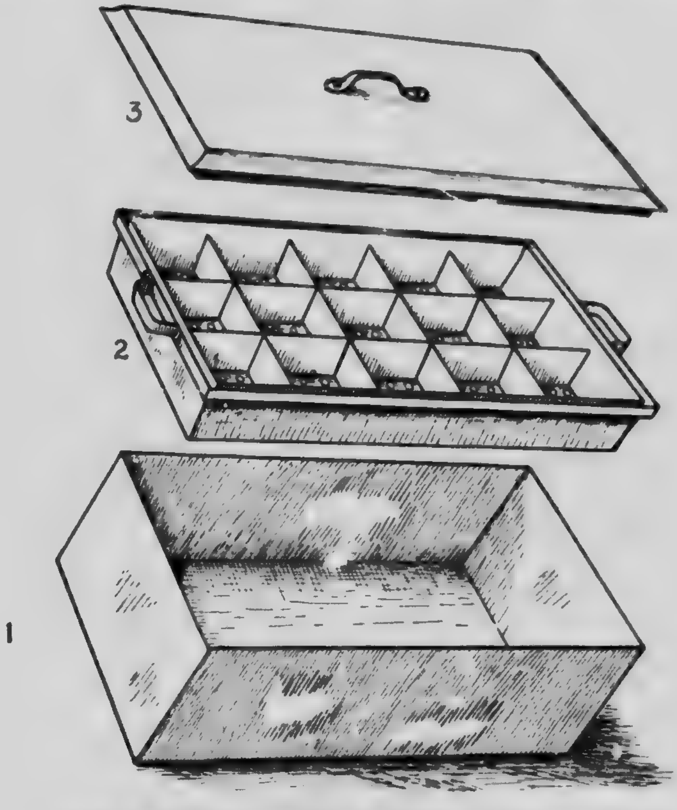
The same system has been used throughout the experiments for testing the table quality of the potatoes. Those who have cooked and examined the potatoes are members of the staff of the Department of Field Husbandry, and they have made a special study of the work. The results are presented with much confidence. The demand in Ontario is for a white, mealy, flaky potato of good flavor and of good appearance.

The following list gives the table quality of each of eighty-two varieties of potatoes from **two to eight years:**

Varieties.	Table Quality. Average Percentage. Perfection—100.				
	8 yrs.	6 yrs.	4 yrs.	3 yrs.	2 yrs.
Empire State	83	83	83	83	84
Pearl of Savoy	79	78	79	77	79
White Elephant	76	75	76	75	76
American Wonder	75	75	71	71	76
Burpee's Extra Early	75	74	74	78	69
Rose's New Invincible	74	75	76	76	80
Early Rose	74	78	72	72	71
Rural New Yorker, No. 2	69	68	65	68	70
Six Weeks	68	66	65	66	63
Irish Cups	64	59	53	51	49
Stray Beauty	50	50	47	46	43
Beauty of Hebron	....	79	80	81	83
Davies' Warrior	....	74	72	78	77
The Howard	....	74	72	75	73
Early Ohio	....	71	67	67	63
Rose of the North	....	71	71	74	69
Lightning Express	....	71	68	70	77
Extra Early Eureka	....	69	68	69	61
Early Fortune	....	66	63	65	60
Carman No. 1	....	65	65	68	70
New White Beauty	....	64	63	56	62
The Hustler	...	61	61	60	54
Sir Walter Raleigh	....	61	59	54	58
Early Pinkeye	....	52	50	47	48
Queen of the Hebrons	....	....	79	79	81
Windsor Castle	....	....	78	79	80
Westcott	....	....	78	77	73
Verifest	....	....	76	77	78
Laurentina	....	....	76	83	81
Silver King	....	....	75	77	75
King Seedling	....	....	75	72	71
Adams	....	....	75	74	83
The Queen	....	....	74	74	69
Moreton	....	....	73	77	75
Ninety Fold	....	....	73	76	79
Brown's Prolific	....	....	72	79	81
Late Faction	....	....	72	75	80
Findlay's Star	....	....	71	70	71
Irish Date	....	....	71	70	68
Cora	....	....	71	76	75
Dalhousie	....	....	71	75	78
Eldorado	....	....	70	71	73
Early Puritan	....	....	69	69	70
Satisfaction	....	....	69	68	66
Early Lima	....	....	68	68	64
Monarch	....	....	68	68	74
Up-to-date	....	....	67	63	60
Delaware	....	....	66	64	70
First Choice	....	....	65	61	58
Dalmeny Acme	....	....	64	63	64
Isle of Jersey	....	....	64	62	58
Noxall	...	....	61	57	54
The Pingree	....	....	61	57	62
Millionaris	....	....	61	58	62
Pan-American	....	....	60	59	58
Irish Cobbler	....	....	58	57	55
Canadian Standard	....	....	58	56	50
Solanium Commersoni Violet	....	....	57	55	58
King Edward	....	....	53	59	63
Derby's Early	....	....	49	50	48
Solanium Commersoni White	....	....	48	46	45
New Golden Gem	....	....	47	51	55
President	....	....	43	44	54
Midlothian	....	....	41	43	46
Read's Golden Gem	....	....	40	31	31
British Queen	....	....	....	73	70
Empire State No. 5	....	....	....	69	63
Ringleader	....	....	....	64	69
Wonderful	....	....	....	59	57
Bermuda	....	....	....	56	51
Golden Nugget	....	....	....	53	50
New Found	....	...	....	50	48
Red Fir	....	....	....	49	43
Ashleaf	....	....	....	48	51
White Fir	....	....	....	45	44
Statesman	....	....	....	....	75
Snowball	....	....	....	....	64
Dooley	....	....	....	....	64
Wee McGregor	....	....	....	....	62
Pride of Kerns	....	....	....	....	62
Manitoba Wonder	....	....	....	....	61

The table quality of the potatoes grown in 1915 was tested from the eleventh to the twentieth of November, and that of 1914 from the fifteenth to the twentieth of June. In other years the cooking has been done in January, April, May and June, so that it will be seen that the potatoes have been tested at various times after harvest.

The results in the table here given represent a large amount of work which has been brought together in the best way for comparison. All varieties named have been tested for the two years, 1914 and 1915. A smaller number of varieties have been tested for three years, and ten varieties for as many as eight years. The only varieties included in this list which were also included in the large table are the ten varieties which have now been tested for table quality for eight years. The varieties are placed on the list in the order of their table quality for the largest number of years in which they have been tested. It will be seen that the Empire State heads the list in table quality of the varieties tested for eight years, the Beauty of Hebron for those tested only six years, the Queen of the Hebrons for those tested only four years, the British Queen for those tested only three years, and the Statesman for those tested only two years. This arrangement will enable the reader to compare the table quality of any variety of potatoes on the list with that of any other variety which has been grown for as many years. For instance, the table quality of the Early Rose can be compared with nine varieties for eight years or with eighty-one varieties for two years, and the Statesman can be compared with all the varieties on the list but only for a period of two years owing to the fact that it has been under experiment for only that length of time.



A Potato Steamer for Cooking fifteen Varieties of Potatoes at one time: (1) Boiler, (2) Receptacle with Fifteen Perforated Compartments, and (3) Cover.

It should be remembered that some of the early varieties such as the Six Weeks, the Stray Beauty and the Early Pinkeye which show comparatively low results in table quality when tested in the winter are usually grown for very early use and are frequently dug before they reach maturity, at which time they would probably surpass in table quality the late varieties. The Early Ohio and the Extra Early Eureka are early potatoes of fairly good quality even in the winter season. For general use it is very difficult to find potatoes which are superior in table quality to the Empire State or to the Beauty of Hebron.

POTATO IMPROVEMENT, INCLUDING SELECTION AND HYBRIDIZATION.

It is believed that the potato has been cultivated in Peru for over two thousand years. In the sixteenth century when the potato was introduced into Europe the plants evidently yielded large numbers of small, irregular tubers, and an abundance of seed. The improvement of the potato through cultivation, selection and hybridization has apparently increased the uniformity and the size and has improved the table quality of the tubers, and has decreased the number of potatoes per hill and the seed producing power of the plants.

There are over one thousand named varieties of potatoes in North America and fully four hundred have been grown under experiment at the Ontario Agricultural College. Many of these are inferior even though they have been extravagantly advertised, some are old varieties under new names, and comparatively few are of sufficient merit to receive high recommendation for general cultivation by the farmers of Ontario. If these few were grown to the exclusion of fully eighty per cent. of the kinds now under cultivation better results would be obtained. Even the few best varieties are not ideal and there is still much important work to be done by improving the best kinds through selection, and by originating new varieties through hybridization with the object of combining the good qualities and of eliminating the undesirable characteristics of the parent varieties.

Selection work with potatoes can be accomplished with good results either by private growers on their own farms or by scientific investigators at the Experiment Stations. The work can be carried out by either individual or mass selections of tubers or of hills.

Mass Selection of Tubers.—In this method selections are made from the general crop of potatoes by carefully picking out for planting for seed production those tubers which are of the desired form and quality, and which are apparently sound and free from disease. Some growers take for seed the average run of the crop which often includes very uneven tubers and sometimes a mixture of different varieties. Possibly some other growers use for seed the culls which have been discarded by the family cook.

An experiment was started in 1896 and was conducted in duplicate in each of twelve years in continuous selection of tubers of different sizes. From each variety, large, medium, small marketable, and small unmarketable potatoes were selected for planting. From the crop produced from these different selections tubers of similar sizes were again selected for planting and this process was continued each season for twelve years. Exactly the same number of tubers of each selection and of each variety were planted on plots which were uniform in size. The plots, however, varied in size in different years, the smallest being one row and the largest three rows each four rods in length. It will, therefore, be seen that the continuous selections were made within comparatively narrow limits. As there were some rotten potatoes in 1903, the weights of which were not ascertained, the results for that year could not be included.

The following table gives the average results of duplicate experiments conducted in each of **eleven years** in the continuous selection and planting of whole potatoes of different sizes:

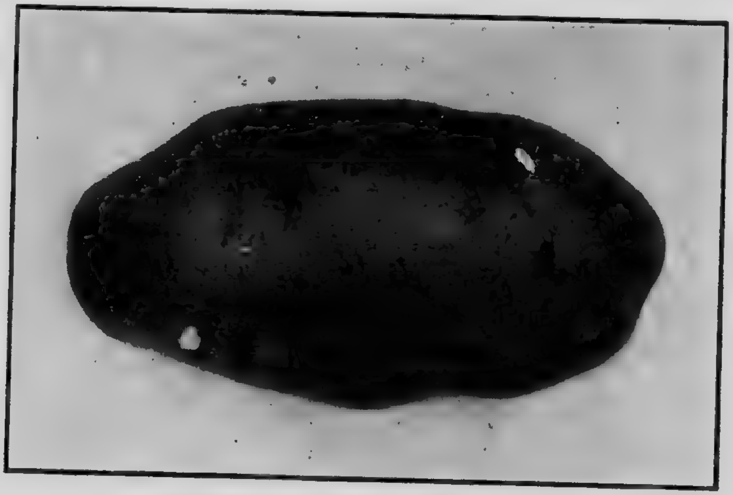
Years.	Yields per Acre from planting whole Potatoes of different sizes. Continuous selection.			
	Small Unmarketable. (Bushels.)	Small Marketable. (Bushels.)	Medium Marketable. (Bushels.)	Large Marketable. (Bushels.)
1896	65.0	105.6	143.8	168.8
1897	190.8	215.6	257.5	283.4
1898	98.8	150.8	196.8	222.5
1899	90.0	160.4	183.1	196.9
1900	48.5	95.2	123.8	187.1
1901	120.8	207.5	292.9	337.9
1902	99.4	115.8	178.1	199.4
1904	96.9	104.1	180.9	128.8
1905	178.8	204.4	220.6	288.8
1906	76.9	105.9	129.1	146.3
1907	93.4	118.8	142.5	174.4
Average yield, 11 years	105.4	145.4	181.2	208.1

It will be seen that in every instance, except one, as the size of the seed potatoes increased there was also an increase in the yield of potatoes per acre. The relative difference in the production of tubers of different sizes is probably more marked in unfavorable than in favorable seasons. It is difficult to ascertain from these results just what influence continuous selection had on crop production, as the size of tuber which is planted exerts a marked influence on the yield of potatoes. For further information on this question the reader is referred to the results of other experiments presented in this bulletin. It is interesting to note that the small, unmarketable potatoes came lowest, and the small marketable potatoes second lowest not only in yield of potatoes per acre but also in the percentage of marketable potatoes produced.

Mass Selection of Hills.—In this method, the selections are made in the field by digging separately the potatoes produced by different plants and by collecting together for seed purposes only those tubers which come from the best hills.

Individual Tuber Selection.—From a bulk lot of potatoes of a suitable variety selections are made of the most desirable tubers regarding colour, smoothness, shape, size, quality, and freedom from disease. These selected tubers are planted whole or in the form of a certain number of sets, and the progeny from each tuber is kept separate from that of every other tuber. By careful testing under uniform conditions these different lots of the one variety the grower aims to secure a superior strain of potatoes.

In the spring of 1909 two hundred and forty-one tubers of the Empire State variety of potatoes were carefully selected from a bulk lot of this variety grown at the College in the year previous. These potatoes were weighed separately and classified into groups of from twelve to twenty-eight tubers each. The individual potatoes comprising any one group did not vary in weight more than one-sixteenth of an ounce. The potatoes were all planted whole and the crop produced from each of the two hundred and forty-one tubers was harvested by itself and the potatoes were counted and weighed. The best hills in each group were carefully noted. In the spring of 1910 one pound from each of forty-three of the most promising hills of the previous year was used for seed. This amount was cut into thirty-three pieces which were planted in one r[illegible] rods in length by placing the sets two feet apart. In 1911 and 1912 the selections were reduced to fourteen, in 1913 to eight, and in 1914 and 1915 to three.



A Potato of the Empire State variety.

The following average yields of potatoes per acre per annum for the past two years show the comparison of the selections with one another and with the Empire State variety, which has not been submitted to the individual tuber selection process:—

Selection No. 1	181.4 bushels.
Selection No. 2	177.3 "
Selection No. 3	175.9 "
Variety	162.5 "

It should be remembered that none but well formed tubers of good size of the Empire State potatoes had been planted at the College for nineteen years before the individual tuber selection work was started. Even from this stock of material the individual tuber selections appeared to have an influence in increasing production.

Individual Hill and Tuber Selection.—This method can be carried out in the large field, the market garden, the family patch, or the nursery plot where potatoes are grown. In ordinary culture, however, the potato sets usually vary in size, and consequently the hills vary in productiveness. In order to select most readily those hills possessing the power of reproducing desirable characteristics care should be taken to plant tubers or sets which are uniform in size. In commencing the work, therefore, it is not only important to use the best variety obtainable for the purpose, but also to give the potatoes in the individual hills an even chance for development. When the crop is beginning to ripen there is frequently a noticeable variation in the appearance of the plants. This permits of a selection of the hills having vigorous plants with the best foliage and the least amount of late blight and of other diseases. The hills can be marked by driving stakes or laths beside those selected. Another examination of the crop can be made in a week or ten days, and still another at a little later date, and, if necessary, some of the stakes changed according to the appearance of the plants. A few days after the tops die the selected hills can be carefully dug with a potato fork and examined individually. The product of each hill showing a good yield of uniform tubers of desirable appearance and free from scab, rot or other diseases can be placed in a separate bag and numbered. The selected potatoes should be kept in a cool, dry, dark cellar during the winter and early spring. At planting time a uniform number of the best potatoes from each bag can be selected and each tuber cut once lengthwise and once crosswise, thus making four sets comparatively even in weight. Two feet could be allowed between the sets and three feet between the tubers in every row. Each tuber of four sets would require 9 feet of the row. The length of the rows, therefore, would be 45 feet if five tubers, 54 feet if six tubers, and 63 feet if seven tubers were used from each bag. Three feet is a good distance to allow between the separate rows. Comparative examinations can be made of the tops in the growing season and of the potatoes in the autumn which have been produced from the individual sets, from the individual tubers, and from the individual hills. This gives an exceptionally fine opportunity for determining the comparative results of the different selections regarding vigor of growth, freedom from disease, and type, uniformity, production and quality of potatoes. Tubers can be taken from the best hills, or from the best groups of four hills, or from the best rows for further selection, for comparative tests, or for both. The writer recommends this individual hill and tuber selection method as one of the best and most interesting which can be followed in obtaining an improved strain of potatoes either for home use or for commercial purposes.

In developing the foregoing system some interesting work has been done at our College. For instance, individual hill selections were made from the Davies' Warrior potatoes in 1910 and again in 1911. Eleven of the best strains resulting from the selections have been tested in duplicate in each of the past **three years** and the following table gives the average results of each of four of these strains as tested in each of the years 1913, 1914 and 1915:—

Selections.	Percentage Table Quality 1915.	Yields of Potatoes per Acre (bushels).			
		1913. 2 tests.	1914. 2 tests.	1915. 2 tests.	Average 3 years. 6 tests.
Selection No. 5	74	210.0	321.0	199.2	**243.4**
" " 2	72	197.5	285.7	166.3	**216.3**
" " 1	71	191.3	253.6	127.5	**190.8**
" " 8	71	145.0	177.1	86.5	**136.2**

These strains were all started from carefully selected hills of promising characteristics, and yet the results show most decided differences in productiveness. The Davies' Warrior potatoes in the variety tests, where no hill selection was used, gave an average of 136.6 bushels per acre per annum for the same period. This work has been valuable in furnishing a strain of Davies' Warrior potatoes which has given an average annual yield of fully one hundred bushels per acre over the ordinary variety. It has also emphasized the value of the application of a good system of selection in the improvement of the potato crop.

Originating New Varieties from Potato Seed.—The potato blossoms are produced on the upper parts of the stems and vary in color. The flower is complete, comprising calyx, corolla, stamens and pistil. The construction of the flower favors self-fertilization. It is very rare to find insects visiting the blossoms. The amount of cross-fertilization through the agency of the wind is uncertain. Early writers inform us that the potatoes of two and three centuries ago produced an abundance of seed. Potato seed in the commercial varieties of the present day, however, is very scarce. The improvement of the potato has developed large yields of tubers which make heavy demands upon the food manufactured by the leaves. It is probably due to this demand that the transfer from seed to tuber production has taken place. The cause of the lack of fertilization of the flowers seems to be due to the sterility* of the pollen, and in the majority of cases the unfertilized flowers drop to the ground. In a few instances, however, fertilization takes place and seed is produced. It is stated that seed production is increased by removing the early formed tubers of the potato plant. The potato "apple" or fruit is globular in form, about three-quarters of an inch in diameter, and contains many seeds which are about the size of pin-heads.

It is a comparatively easy matter to produce new varieties of potatoes from the seed. It is an exceedingly difficult process, however, to produce a new variety of potatoes which is superior to the best kinds already in existence. That scientific workers will eventually produce potatoes of high merit by means of artificial cross-fertilization of varieties, possessing the most desirable characteristics, is fully expected. It is probably safe to say that this line of work will be confined largely to the Agricultural Experiment Stations. Much may be done, however, by private citizens who revel in scientific work and who have time and money at their disposal and a wholesome desire to be of real service to humanity.

PLANTING POTATOES AT DIFFERENT DATES.

In four separate experiments potatoes were planted at different dates. In one experiment the planting on May 14th surpassed that of the planting of May 28th. In another experiment, which was only conducted for one year, potatoes which were planted on May 4th gave the highest, on May 23rd the second highest, and on June 13th the third highest yield per acre. In still another experiment potatoes were planted on May 31st, June 14th, June 28th and July 12th, thus allowing two weeks between each two dates of planting. This experiment was conducted in duplicate by using two early, two medium, and two late varieties of potatoes in each of the six years. It will, therefore, be seen that there were thirty-six separate tests in this experiment. Exactly the same weight of seed and the same number of sets were used throughout. All other details in reference to cultural methods were the same for all of the plots in each of the years.

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*Wm. Stuart, U.S. Department of Agriculture, Bulletin 195, on "Potato Breeding and Selection," 1915.

The following table gives the results of thirty-six tests conducted over a period of **six years** in planting early, medium and late varieties of potatoes at four different dates:—

Dates of Planting	Average Percentage Maturity. Sept. 10th.	Bushels per Acre of Marketable Potatoes. 36 tests.	Total Yield of Potatoes per Acre (bushels). Average six years.			
			EARLY Varieties. 12 tests.	MEDIUM Varieties. 12 tests.	LATE Varieties. 12 tests.	Average of three classes of Varieties. 36 tests.
May 31	91	164.5	163.8	201.9	203.5	189.7
June 14	78	146.6	152.0	183.9	191.9	175.9
June 28	44	101.8	104.7	149.1	147.5	133.8
July 12	10	46.6	67.6	76.4	75.4	73.1

The results show that in all of the average results, whether of marketable potatoes or of total yield of early, medium or late varieties, the yield was the highest from the earliest planting. As the different dates of planting advanced the yield per acre decreased to a marked degree. In every instance the yield per acre from the planting of May 31st was more than double that from the planting of July 12th. It should be considered that these experiments were conducted at Guelph on an ordinary clay loam.

The experiment last described was concluded in 1914. In the following year a somewhat more extensive experiment was started by planting potatoes at six different dates. In all six varieties of potatoes were used, two early, two medium, and two late. The conditions of culture were the same throughout as near as it was possible to have them.

The following table gives th[illegible]ge results in percentage of table quality and yield per acre of six varieties of [illegible] grown from each of six different dates of planting in 1915:—

Dates of Planting.	Average Table Quality. 1915. Percentage.	Average Yield per Acre. 1915. (Bushels.)
May 3	71	201.3
May 17	71	169.6
May 31	68	123.1
June 14	64	72.1
June 28	52	31.8
July 12	39	5.8

It will be seen that the results of each of the four experiments conducted at the College all favor comparatively early planting, and that as the dates of planting increase the yields per acre decrease. According to the results of experiments conducted at our College immature potatoes are of inferior quality for eating in the winter, but are of superior value for planting in the spring.

DIFFERENT EXPOSURES OF SEED POTATOES FOR THREE WEEKS BEFORE PLANTING.

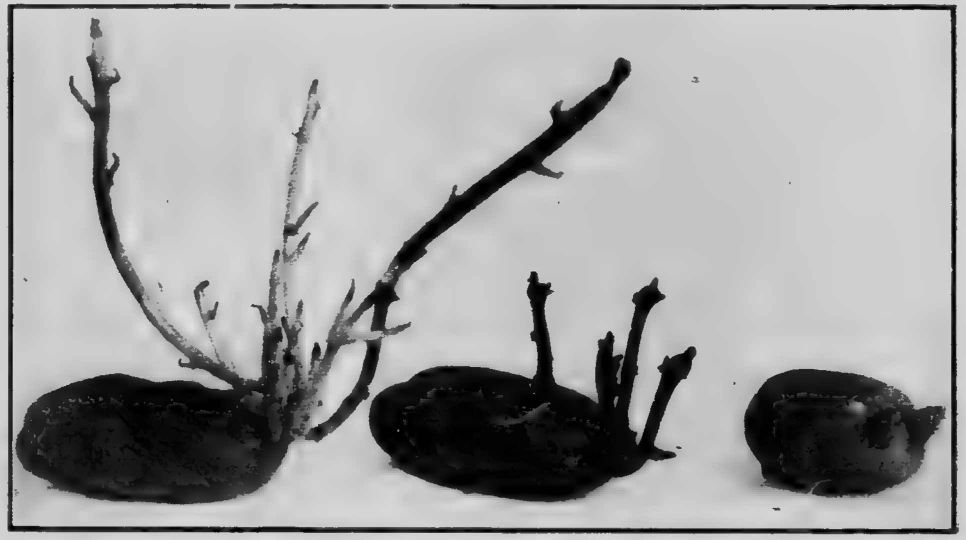
For five years in succession an experiment was conducted in which potatoes were carefully and evenly divided into different lots and placed in varying degrees of light and heat for three weeks before they were planted. Some were placed in the dark cellar, others in the cellar in front of a window, others on the barn floor, others in the greenhouse immediately below the glass, and others in the open air. Two varieties were used each year. The different lots of each variety were made up of the same weight and of the same number of tubers. The potatoes were weighed and distributed each year in the latter part of May and the planting took place three weeks later. The potatoes placed in the dark cellar grew long, tender, light colored sprouts, while those placed in the warmer temperature and in the light produced short, green-colored sprouts. One-half of the potatoes kept in the dark cellar were planted with the sprouts removed, and the other half with the sprouts still attached to the tubers. The following table gives the average percentage marketable, the yield marketable and the total yield per acre for the ten tests in the **five years** for each of the six treatments:

Places where Potatoes were kept for twenty-one days before planting.	Average Percentage Marketable.	Average Bushels per Acre per Annum.	
		Marketable.	Total Yield.
1. In barn in light (sprouts on)	77.9	187.1	**221.1**
2. In root cellar in light (sprouts on)	74.4	173.8	**210.8**
3. In root cellar in dark (sprouts on)	74.1	169.4	**206.0**
4. In greenhouse in light (sprouts on)	59.8	134.6	**188.3**
5. In root cellar in dark (sprouts off)	63.1	130.5	**177.3**
6. In open air (sprouts on)	58.2	62.9	**107.3**

Potatoes which were placed on the barn floor in the latter part of May and allowed to remain there for three weeks, after which they were planted whole with the short sprouts attached, gave better results than tubers submitted to any other exposure in total yield and in yield of marketable potatoes per acre. The potatoes which were kept for three weeks in a dark root cellar and which were carefully planted with the slender sprouts attached gave an average yield of 28.7 bushels per acre more than similar potatoes from which the sprouts had been removed. These results go to show that seed potatoes from which sprouts have been removed in the spring before planting are considerably weakened for crop production. The results also show that if seed potatoes are allowed to sprout in the spring their value depends largely upon the conditions under which the sprouts are allowed to develop before the time of planting. The tubers which were exposed to the open air were injured considerably by the changes in temperature. The results seem to favor the practice of allowing potatoes to sprout under proper conditions in the spring not only to hasten the crop for early market but also to furnish good yields of tubers. Unfortunately, no potatoes were kept sufficiently cool to prevent any sprouting so as to furnish unsprouted seed as a basis of comparison.

In another experiment conducted in duplicate, but for only one season, potatoes which had been kept in a dark, moderately cool root cellar produced long slender sprouts in the spring. These potatoes were separated with great care and part of them were planted with the sprouts attached, and an equal number after the sprouts had been removed. The potatoes were planted whole, and the cultural methods were the same for the different plots. The average yield of potatoes produced was 26.3 bushels per acre less from the tubers from which the sprouts had been removed than from those on which the sprouts were attached. These results confirm those of the former experiment and show that if potatoes are allowed to sprout in the spring of the year and the sprouts are removed the value of the tubers for crop production is apparently decreased.

When a whole potato is exposed to the light a very few of the eyes start to grow, and these are generally situated at or near the seed end. The accumulated resources of the potato are largely devoted to the development of the few sprouts which start first and many of the eyes remain in a dormant condition. In the earliest stages of growth the food material of the young sprouts appears to be drawn from that portion of the tuber which is at the greatest distance away from the new growth.



Three Sprouted Potatoes: (1) Placed in the dark, (2) Placed in the dark for a time and later in the light, and (3) Placed in a subdued light.
Potatoes placed in the light until short, thick, green sprouts are grown to an inch or so in length make excellent seed, especially for producing a crop for early market.

Seed potatoes placed in shallow trays and stored for a short time before planting in a moderately warm, well ventilated and lighted room are likely to give excellent returns. By this process the sprouts will be short, dense, full of color and strong enough to withstand ordinary handling. The young sprouts will develop buds near the potatoes which probably accounts for the increase in productiveness. The sprouted tubers hasten the season of growth and produce fine, healthy plants which are more likely to escape blight. This method is particularly advantageous if the grower is desirous of having his crop ready for market very early in the season.

PLANTING WHOLE AND CUT POTATOES.

Various experiments have been conducted in different countries and at different times to glean information regarding the best way to prepare potatoes for planting. In order to glean data along this line which might be of particular value to the potato growers of Ontario an experiment was conducted for six years in succession. In this experiment potatoes of different sizes were planted whole at different distances apart, and in comparison with these cut pieces of different sizes were planted from uniform tubers. The experiment was conducted in duplicate in each of the first two years, and in triplicate in each of the last four years. It will, therefore, be seen that we conducted sixteen complete and separate tests in the six-year period. The varieties of potatoes principally used were the Empire State, the Pearl of Savoy, and the Rural New Yorker No. 2. The quantity of seed per acre varied according to the manner of preparing the seed. The potatoes were planted in rows 3 1-3 links apart, and the planting took place from the fourteenth of May to the fifth of June, according to season. The treatment of the land was the same as has been described for the experiment with different varieties. The following table gives the average results in percentage of crop marketable, in total yield per acre, and in yield per acre less seed used, in the experiment comprising sixteen tests conducted over a period of **six years:**

Preparations.	Percentage of Crop Marketable. Average 6 years.	Yield per Acre. Average 6 years (bushels).	Yield per Acre less seed used. Average 6 years (bushels).
Large whole, one foot apart	79.25	338.03	110.98
Large whole, two feet apart	84.00	247.75	133.00
Large whole. three feet apart	85.83	200.26	125.49
Medium whole, one foot apart	82.07	274.01	179.81
Medium whole, two feet apart	87.37	210.36	163.39
Small whole, marketable, one foot apart	87.83	201.03	176.54
Medium cut in two, one foot apart	83.95	211.32	163.45
Medium, two eyes in a piece, without seed ends, one foot apart	90.57	153.21	135.45
Medium, one eye in a piece, without seed ends, one foot apart	91.39	106.46	96.38
Medium, seed ends, one foot apart	85.57	104.24	98.22

It will be seen that the largest yield of potatoes and the lowest percentage of marketable tubers were produced from the large whole potatoes planted one foot apart in the rows. This required the largest amount of seed of any of the ten plots comprising this experiment. The yield per acre decreased as the distance between the potatoes in the rows increased or the size of the potatoes decreased. The highest perecntage of marketable potatoes was produced from the cuttings having only one eye in each piece. The results show that the amount of seed used has a marked influence on the yield of potatoes per acre. The heaviest planting, however, has two serious drawbacks, viz., the large amount of potatoes required to plant an acre and the large percentage of unmarketable potatoes in the crop produced. The last column to the right gives the yield per acre remaining after subtracting the amount of seed planted from the total crop produced. It will, therefore, be seen that the most economical results were not obtained either from the largest or the smallest amount of seed used. This experiment has some important lessons in itself, but it is particularly valuable in suggesting other lines of investigation, and we would advise the reader to examine the results of the experiments given under the headings which follow before drawing conclusions from the results presented in connection with this experiment.

An interesting little experiment was conducted in planting very small whole potatoes of about one-quarter of an ounce in size in comparison with small whole potatoes weighing about one ounce each. The number of potatoes was uniform throughout. The results showed that the very small potatoes gave slightly less than one-half the yield per acre as compared with the one ounce tubers.

PLANTING SETS OF DIFFERENT SIZES WITH ONE EYE IN EACH SET.

Suggested by the results of the foregoing experiment a test was arranged with the object of securing more definite information regarding the exact influence of the size of the cut potato on the resulting crop. This experiment consisted of six separate plots in which potato sets 1-16, ⅛, ¼, ½, 1 ounce and 2 ounces in weight were planted under similar conditions. No piece contained more than one eye. The pieces were planted one foot apart in the rows, there being exactly the same number of sets used in each of the plots. The experiment was conducted in duplicate in each of five years by using two varieties each season. There were, therefore, in all ten tests conducted during the five-year period. The potato sets were planted to a depth of about four inches, and flat cultivation was used each year. The following table gives the average of **five years'** results in testing potato sets of each of six different sizes:

Size of Sets Planted	Eyes per Set.	Amount of Seed used per Acre (bushels).	Average results for five years (10 tests).			
			Percentage of Crop marketable.	Yield per Acre (bushels).		
				Marketable.	Total.	Total less Seed used.
One-sixteenth oz.	1	1.3	61.0	36.8	47.5	46.2
One-eighth oz.	1	2.6	88.6	78.8	89.7	87.1
One-quarter oz.	1	5.2	89.7	98.4	111.1	105.9
One-half oz	1	10.3	88.7	109.4	129.0	118.7
One oz.	1	20.6	89.5	129.9	148.4	127.8
Two ozs.	1	41.2	87.6	149.7	173.9	132.7

The results here presented are certainly interesting. They show that the size of the piece of potato planted has a very marked influence on the yield produced. Under exactly similar condtions there was a variation of from 47.5 to 173.9 bushels of potatoes per acre per annum owing to the difference in the size of the potato sets which were planted. There was an increase in the yield of potatoes per acre as the size of the potato sets increased in weight. Planting two-ounce in comparison with one-ounce pieces an additional 20.6 bushels of seed potatoes were required, and an additional yield of 25.5 bushels of potatoes were harvested. Of this quantity, however, only 19.5 bushels per acre were of marketable size, therefore, on the average the one-ounce pieces proved more economical than the two-ounce sets.

An experiment was conducted for only one year in testing single eyes with large and small amounts of tuber material attached. In this experiment large potatoes of uniform size were selected and all the eyes were removed and thrown away excepting two of the strongest appearing ones on each potato. One of these eyes on each tuber was then removed with a small piece of potato attached. approximately one-sixteenth of an ounce in weight, and the remaining part of the potato, about eight ounces in weight, was left attached to the other eye. It will be observed that the eyes of these two sets were similar in every respect except in the one particular, viz., that there was only a small amount of the fleshy part of the potato attached in one case, while in the other there was a large amount of the fleshy part of the potato attached to the eye. An equal number of sets of each selection were planted. The experiment was conducted in duplicate, there being four plots in all. The soil and methods of cultivation were similar. The large potato sets with single eyes gave an average yield per acre of 340, and the small sets with single eyes of 48.1 bushels per acre. This is an extreme test and shows the very great difference which it is possible to obtain from potato eyes of uniform strength, but which are furnished with different amounts of nourishment for the young plants.

PLANTING SETS OF DIFFERENT SIZES AND AT DIFFERENT DISTANCES APART.

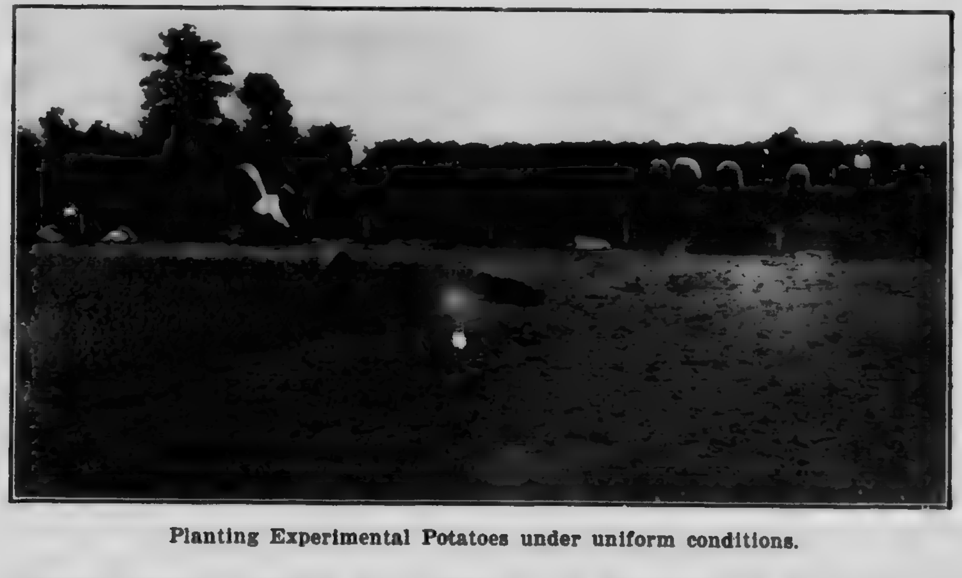
Based on the results presented in connection with the last experiment another test was started by planting potato sets of 1 ounce, 1½ ounces and 2 ounces in size at distances of 12, 18 and 24 inches apart in the rows. The experiment, therefore, consisted of nine separate plots and it was conducted in duplicate each season, and for a period of five years. Each piece contained only one eye. The potato sets were planted to a depth of about four inches and flat cultivation was used each year. The rows were 26⅖ inches apart in every instance. The following table gives the average of the ten tests conducted in **five years** in planting different sized sets at different distances apart:

Size of Sets Planted	Distance between Sets in rows (inches).	Amount of Seed used per Acre (bushels).	Average results for five years (10 tests).			
			Percentage of Crop marketable.	Yield per Acre (bushels).		
				Marketable.	Total.	Total less Seed used.
One oz.	12	20.6	86.8	125.8	144.9	124.3
	18	15.5	88.1	116.7	132.5	117.0
	24	10.3	89.5	102.1	114.1	103.8
One and one-half ozs.	12	30.9	84.0	140.2	166.9	136.0
	18	23.2	87.0	125.9	144.7	121.5
	24	15.5	87.7	103.3	117.8	102.3
Two ozs.	12	41.2	84.1	150.8	179.3	138.1
	18	30.9	86.7	125.0	151.2	120.3
	24	20.6	88.3	118.4	134.1	113.5

It will be seen that the total yield of potatoes increased as the size of the cut tubers increased in weight and as the space between the tubers decreased in distance. The highest yield per acre was produced from the two ounce sets placed one foot apart, and the lowest yield per acre from the one ounce sets placed twenty-four inches apart in the rows. The extremes in the yields per acre corresponded with the extremes in the amount of seed used and in the distance between the sets. The percentage of marketable potatoes was highest where the smallest potato sets were planted at the greatest distances apart. The highest yield per acre, less the amount of seed used, was produced from the two ounce pieces one foot apart in the rows. This, however, required a large amount of seed. Under average conditions seed potatoes in the spring are more valuable than an equal quantity of potatoes in the autumn, therefore, the heaviest seeding in this experiment, although the most productive in total yield and in total yield less the amount of seed used, was not the most economical. The results here presented in tabulated form are very suggestive and are worthy of careful study. If seed potatoes are plentiful and cheap it might be wise to use some of the larger amounts of seed per acre. If, however, the potatoes are scarce and expensive some of the smaller amounts of seed per acre would probably prove the most satisfactory.

PLANTING SETS OF EQUAL SIZE WITH A VARYING NUMBER OF EYES.

The proper number of eyes to leave in each potato set has been discussed on many occasions. As the size of the set itself has a marked influence on the yield of potatoes it is important to use sets of uniform size if definite results from a different number of eyes are to be obtained. An experiment has been conducted in our experimental plots in which every set was cut so as to weigh one ounce, but in which the number of eyes in the different sets varied from one to five. Great pains were taken to have all the pieces of exactly the same size—in fact every piece was weighed by itself on a fine balance and was trimmed as required. For No. 1 plot each set contained one eye, for No. 2 plot two eyes, for No. 3 plot three eyes, for No. 4 plot four eyes, and for No. 5 plot five eyes. The experiment was conducted in duplicate each year by using two varieties of potatoes and it was



Planting Experimental Potatoes under uniform conditions.

continued for five years in succession. The potato sets were taken from uniform tubers and some of the eyes were removed in accordance with the requirements of the experiment. The conditions of planting were the same as those given in the variety experiment.

The following table gives the average results of five years' experiments in planting one ounce potato sets containing from one to five eyes each:

Number of Eyes in ounce Sets.	Average results for five years.		
	Weight of 30 largest Potatoes per plot (lbs.)	Percentage of Crop Marketable.	Yield of Potatoes per Acre per annum (bushels).
Each Set containing 1 oz. and 1 Eye .	9.8	86.2	139.8
" " 1 " 2 Eyes.	9.2	84.6	151.2
" " 1 " 3 "	9.0	82.6	153.9
" " 1 " 4 "	8.6	81.2	161.3
" " 1 " 5 "	8.5	83.3	165.1

The potato sets of one ounce in size and containing one eye each produced the largest potatoes, and the highest percentage of marketable tubers, but the lowest yield per acre. With one slight exception as the number of eyes increased from one to five in the potato sets of one ounce each there was a decrease in the size of the largest potatoes, a decrease in the percentage of crop marketable, and an increase in the average yield of potatoes per acre per annum. The sets containing five eyes each produced twenty-five bushels per acre more than those containing one eye each in the average annual yield for the five-year period. This would be an increase of practically six bushels per acre for each additional eye in the potato sets which were planted. The highest average yield of marketable potatoes per acre was produced from the sets containing five eyes, and the lowest average yield of marketable potatoes from the sets containing one eye each. From observations made of the vines growing above ground it was found that on the average there were three stems from the one-eyed sets and four and one-half stems from the five-eyed sets.

It is the opinion of some people that potato sets should always be planted with the eyes facing upwards. An experiment was conducted in one year in which potatoes were cut into flattened sets. In one plot every set was placed with the eyes downwards, and in another with the eyes upwards. The experiment was conducted in duplicate. The average yields per acre from the two methods were practically identical. In dropping potato sets it is not now considered important to have the eyes pointed in any one specific direction.

PLANTING SINGLE EYES FROM DIFFERENT PARTS OF THE SEED TUBERS.

In each of five years, an experiment was conducted by planting single eyes of potatoes taken from different parts of the tubers. As the yield of potatoes per acre varies with the size of the sets planted, great care was taken to have the pieces planted of exactly the same weight by actually weighing all the pieces separately. The experiment was, therefore, a test of the comparative value of the eyes and was not influenced by the difference in the size of the pieces planted. Uniform potatoes of the same varieties were used for supplying the sets. Where necessary to meet the requirements of this experiment, the surplus eyes were removed from the sets leaving only one eye in each piece. The experiment was conducted with at least two varieties of potatoes each year, so that the results represent the average of at least ten separate tests. The cultural methods were the same as those described under the variety experiment. The following table gives the average results for **five years** from testing single-eyed sets taken from different parts of the tubers:

Potato Sets of uniform weight, and containing single Eyes taken from different parts of the tubers.	Average results for five years.		
	Weight of 30 largest Potatoes per plot (lbs.)	Percentage of Crop marketable (4 years).	Yield per Acre (bushels).
Middle portion	12.4	85.8	174.8
Stem end	11.5	82.1	167.7
Seed end	11.9	84.2	162.8

In four out of the five years, the eyes taken from the central portions of the potatoes produced the highest yields per acre and, in one year, the eyes taken from the seed ends of the potatoes were the most productive. In the average results for the five-year period, the eyes taken from the seed ends produced potatoes which came second in percentage of marketable tubers and lowest in total yield of potatoes per acre. In yield of marketable potatoes, there was only a difference of 1.3 bushels per acre between the results from the eyes taken from the stem end and from the seed end of the tubers. The results from the eyes taken from the central part of the potatoes gave the best returns in every respect.

In comparing these results with those of somewhat similar experiments conducted elsewhere it should be remembered that in the experiment here reported all of the potato sets weighed exactly the same amount and the individual pieces contained precisely one eye each. If the sets taken from the different parts of the potatoes were of uneven weights and contained a varying number of eyes there would be a combination of three determining factors, and the results would be difficult of interpretation. The force of this statement will be understood if the reader will make a study of the results already presented in this bulletin in reference to planting one-eyed sets of different sizes and one-ounce sets with a varying number of eyes.

PLANTING ONE, TWO AND FOUR POTATO SETS PER HILL.

An experiment was conducted in each of seven years by planting one, two and four potato sets per hill. The hills were the same distance apart in both cases and the amount of seed used per acre was uniform throughout. In each test, Plot No. 1 contained one whole potato of two ounces in weight per hill, Plot No. 2, two half potatoes of one ounce each per hill, and Plot No. 3, four quarter potatoes of one-half ounce each per hill. The experiment was conducted in duplicate each year, in some seasons the same variety of potatoes being used in both tests, and in other seasons different varieties of potatoes being used in the two tests. In the seven-year period there were fourteen distinct tests conducted. The treatment of the soil and the method of planting were similar to those described for the variety experiment. The following table gives the average of **seven years'** results in growing potatoes with one set, with two sets, and with four sets per hill:

Number of Sets Planted per Hill.	Weight of Sets Planted per Hill (ozs.).	Average Results for Seven Years.			
		Weight of 30 Largest Potatoes per Plot (lbs.).	Percentage of Crop Marketable.	Bushels per Acre.	
				Marketable.	Total.
One Whole Potato	2	10.9	81	154.9	187.7
Two Half Potatoes	2	10.4	77	145.8	183.1
Four Quarter Potatoes	2	8.9	72	124.6	165.4

The results of this experiment were very decided throughout. In each of the seven years the two-ounce whole potatoes gave the highest percentage, and the four half-ounce sets per hill gave the lowest percentage of marketable potatoes. The four sets of potatoes per hill gave the lowest yield of marketable potatoes, and with only one exception the lowest total yield of potatoes per acre in each of the seven years during which the experiment was conducted. The average results for the whole period show that two-ounce potatoes when planted separately gave an annual average yield of fully 30 bushels per acre of marketable potatoes more than the same amount of seed planted in the form of four one-half ounce pieces per hill. When a whole potato is planted a comparatively small number of the eyes start to grow and the nourishment in the potato goes to produce a few strong vigorous stems. By cutting the potato into small pieces practically all of the eyes are forced into growth. The cutting of the potato, therefore, tends to increase the number of stems produced, and when from two to four potato sets are planted in one place there is a greater number of stems produced than when one larger piece of the same total weight is used. The more pieces there are per hill the greater is the tendency to produce numerous stems which are weak, small and slender and which produce a large number of small potatoes, and a comparatively light yield per acre.

INFLUENCE OF PLASTER AND LIME WHEN SPRINKLED ON FRESHLY CUT SEED POTATOES.

The practice of sprinkling freshly cut seed potatoes with plaster (gypsum), lime or some other material is not entirely new. The use, however, of these materials is confined chiefly to a few potato growers and to seedsmen who sometimes forward potato eyes by mail. In order to obtain data which would form a serviceable guide in regard to the treatment of freshly cut seed tubers an experiment was conducted for five years in succession in which freshly cut seed potatoes were sprinkled with plaster or with lime, or were left untreated before planting. In order to secure as accurate results as possible six separate tests were made in one year, and four separate tests in each of the other four years. In the five-year period, therefore, no less than twenty-two tests were conducted. Finely ground land plaster and slaked lime were used. The planting took place in the latter part of May or in the first week of June each year, and equal amounts of seed were used on the different plots. The cultural methods were practically the same as those given in the variety tests.

The following table gives the average of twenty-two tests conducted for **five years** in treating freshly cut seed potatoes in different ways before planting.

Treatment of Freshly Cut Seed Potatoes.	Weight of 30 Largest Potatoes per plot (lbs.). Average 5 years.	Percentage of Crop Marketable. Average 4 years.	Yield per Acre (bushels). Average 5 years.
Coated with Ground Plaster.............	13.9	81.1	214.4
Coated with Slaked Lime	13.6	78.9	208.6
Not Treated	12.8	78.8	190.8

The average results show that freshly cut potatoes which were coated with land plaster gave 23.6 bushels per acre per annum over those which were left untreated. The results from the sets treated with lime occupied an intermediate position between those from the sets treated with land plaster and those left untreated. In each of four out of the five separate years the plaster coated sets produced the highest total yield per acre, and also the highest percentage of marketable potatoes. The average weight of the largest potatoes produced from the coated seed was higher than that of those produced from the untreated sets.

Another experiment was conducted for seven years in succession in which finely ground brick and road dust were each used for coating freshly cut seed potatoes in comparison with land plaster. The average results of fourteen tests made in seven years show the following yields of potatoes in bushels per acre per annum: untreated, 179.4, road dust, 186.0, ground brick, 189.5, and land plaster 191.1.

In the average results for twelve years untreated seed gave an average of 184.1, lime coated seed, 199.3, and plaster coated seed, 200.8 bushels per acre per annum. The results varied somewhat in different years but in the majority of the tests the land plaster or gypsum gave better returns than slaked lime for coating the freshly cut seed tubers.

Based on experiments which were conducted at the College a co-operative test was arranged through the medium of the Experimental Union. This was repeated in each of five separate years during which time there were 97 good reports of successfully conducted experiments received, or an average of about twenty per year. The experiment consisted of one plot of freshly cut potatoes which had been untreated, in comparison with another plot of exactly the same size and containing an equal number of sets which had been coated with land plaster as soon as cut. The same amount of seed was used in the two plots. Definite quantities of both the seed and the land plaster were forwarded from the College to the experimenters. The average results for the five years show that the coated seed gave a yield of 187.7 and the untreated seed of 177.6 bushels, or a difference of 10.1 bushels per acre per annum in favor of the use of the land plaster on the freshly cut sets. The coated sets gave the largest average yield per acre in each of four years, and in the other year the results were about equal. The experimenters were quite generally in favor of the use of land plaster for coating freshly cut seed potatoes as the result of their experimental work.

From the results of the various tests which were conducted both at the College and throughout Ontario it will be seen that there has been a decided advantage from coating freshly cut seed potatoes with some powdered material. Of the different materials used the finely ground land plaster or gypsum has proved the most satisfactory in increasing the yields of potatoes per acre. The land plaster or gypsum is secured from mines at Caledonia, at Cayuga, and at other places in Ontario. It is obtainable at a comparatively low cost.

PLANTING POTATO SETS AT DIFFERENT TIMES AFTER CUTTING.

It has been the opinion of some potato growers that it was an advantage to cut seed potatoes three or four or five days before they were planted. Possibly potatoes have been cut on a rainy day or on a Saturday when the children were not at school and the cut pieces were planted a few days later and fairly good yields were obtained. If such a method could be followed satisfactorily, it would often prove a convenience especially for the older people if not for the children. An experiment was conducted at the College for eight years with the object of securing definite information regarding the best time for planting potatoes after being cut for seed. At least two varieties of potatoes were used each year. Two lots of potatoes, each containing the same number and the same weight of tubers of each variety, were used. One lot of each variety of potatoes was cut from four to five days before the time of planting and the other lot of each variety was cut and planted on the same day. The cultural methods were uniform throughout and, as all the potatoes belonging to this experiment were planted at the same time, it will be seen that the one point of comparison was the difference in the time of planting the seed potatoes after they were cut. The following table gives the average of sixteen separate tests conducted in **eight years** from planting potatoes at different times after cutting:

Time of Cutting and of Planting Seed Potatoes.	Percentage of Crop Marketable. Average 8 years.	Yield of Potatoes per Acre (bushels). Average 8 years.
Potatoes cut and planted on the same day................	77.4	**170.1**
Potatoes cut four or five days before planting.............	76.3	**162.3**

It was, at first, the intention to cut a part of the potatoes four days before planting. On a few occasions, however, it was not possible to plant the potatoes satisfactorily until five days after they were cut. In the average results of the experiment which was conducted in each of eight years, the potatoes which were cut and planted on the same day gave an annual yield of 7.8 bushels per acre per annum more than those which were cut from four to five days before they were planted. Not only was there a larger yield per acre but there was also a larger percentage of marketable potatoes produced from the seed tubers which were cut and planted immediately. The best results were obtained from cutting and planting the potatoes immediately whether or not they were sprinkled with any material, such as: land plaster, slaked lime, road dust or ground brick.

Thinking that the different kinds of soil might have some influence in the results from growing potatoes from seed cut at different times, a co-operative experiment was conducted through the medium of the Experimental Union in order to glean further information and to enable the farmers to secure definite knowledge along this line of investigation. Seed of the same variety was carefully weighed into two lots and was sent from the College to each experimenter who applied for the experimental material in each of five years. Each experimenter was asked to cut one lot of potatoes five days before planting and to cut the other lot into an equal number of pieces five days later. All the potatoes were to be planted on the same day. It was evidently difficult for all the experimenters to plant on the fifth day, as for instance, in one year there were 218 good reports of successfully conducted experiments throughout Ontario. Of this number, 17 were planted four days, 192 five days, and 9 six days after the first lot of potatoes had been cut. The results of the co-operative experiments show that the potatoes which were planted immediately after they were cut surpassed in yield per acre those which were cut four, five and six days before planting in each year of the test. The average of over three hundred tests throughout Ontario in the five-year period show a yield of potatoes per acre per annum of 16.6 bushels in favor of cutting and planting immediately.

It will be seen that the results of experiments conducted at the Ontario Agricultural College and also throughout Ontario are decidedly in favor of planting potatoes immediately, rather than four, five, or six days after being cut.

PLANTING SEED POTATOES AT DIFFERENT DEPTHS.

The most suitable depth for planting seed potatoes depends somewhat upon the character of the soil and upon the method of cultivation. It should be remembered that the soil on which the experiments are conducted at the College is what might be termed an average clay loam, and the results in depth of planting would probably be somewhat different than those obtained from either a light, dry, sandy or a heavy, damp, clay soil.

Potatoes were planted in the experimental grounds at the College to a depth of one inch, three inches, five inches and seven inches in each of seven years. From two to four varieties were used each season. In the experiment extending over a period of seven years there were twenty-two separate tests conducted. All details in connection with the methods of culture were identical throughout the test as near as it was possible to have them, with the one exception of the variation in the depth of planting. The potatoes were planted in the latter half of May or in the first week of June according to the season. Level cultivation was practised throughout.

The following table gives the average results of twenty-two tests conducted in **seven years** in planting potatoes at four different depths:

Depth of Planting.	Depth of new Potatoes below surface. Average 3 years (inches).	Yields per Acre (bushels).	
		Marketable Potatoes. Average 5 years.	Total crop. Average 7 years.
One inch	1.7	177.4	192.4
Three inches	3.0	188.9	202.8
Five inches	4.0	188.6	206.2
Seven inches	4.9	164.1	188.6

In the individual years there was a considerable difference in the results from the different depths of planting. The largest yield per acre was obtained from planting at a depth of seven inches in one year, and of one inch in another year. The deep planting gave the highest returns in a dry season and the shallow planting in a season when there were frequent rains. The planting at a depth of five inches gave the highest yields in the greatest number of years, and stood the highest in annual yield per acre per annum for the whole period of seven years. When we take into consideration the yield of marketable potatoes we see there is practically no difference in the results from the plantings of three and five inches in depth. On examining the depth of the new crop of potatoes it was found that those which were produced from the three-inch planting were three inches deep, from the one-inch planting nearly two inches deep, and from the seven-inch planting nearly five inches deep. The potatoes in any one plot were not at a uniform depth, but the figures here presented in tabulated form are about the average. Some of the potatoes from the shallower plantings came so close to the surface that they were more or less sunburnt. On an examination of the potatoes produced from the different depths of planting, it was found that the percentage of sunburnt potatoes amounted to practically 33 from the one-inch planting, 4 from the three-inch planting, and nothing from the five and the seven-inch plantings. In regard to quantity and quality of potatoes the best results were obtained from planting at a depth of from three to five inches. Another interesting experiment would be to carefully test the comparative results of planting at the depths of three, four and five inches.

METHODS OF CULTIVATION.

A number of experiments have been conducted in the Field Husbandry Department at the Ontario Agricultural College in the use of different methods of cultivating potatoes. Attention is again drawn to the fact that the soil in which these experiments were conducted was what is usually termed an average clay loam and was fairly well under-drained.

In each of nine years, a combined experiment was conducted to determine the

The appearance in the spring of land which in the previous autumn had been placed into ridges thirty inches apart by means of a double mould-board plow.

influence of planting in rows and in squares, and in comparing hills or ridges with level cultivation. Each test consisted of three plots, the first being planted in rows twenty-six and two-fifth inches apart with the potatoes one foot apart in the rows, and the second and third each being planted with the potatoes thirty-three inches apart each way. Plots number one and two received level cultivation, and plot number three was hilled. The experiment was conducted in duplicate in each of nine years. In eight out of the nine years, two varieties of potatoes were planted, and the other year the one variety of potatoes was used in the duplicate test. The three plot experiment was, therefore, conducted eighteen times. The potatoes were planted at exactly the same rate of seed per acre in the different plots of the experiment. The individual sets planted in the rows would, therefore, be smaller than those planted in the squares, as the former constituted the larger number. The following table gives the average results of eighteen tests conducted in **nine years** with potatoes planted in rows and in squares and cultivated in hills and on the level:—

Method.	Cultivation.	Average Annual Results for nine years.		
		Weight of 30 largest potatoes per plot (lbs.)	Yield of marketable potatoes per acre (bush.)	Total yield per acre (bush.)
Rows 27 inches apart	Level	11.0	162.9	**183.8**
Squares 33 inches apart	Hills or ridges	12.1	143.0	**161.6**
Squares 33 inches apart	Level	12.6	129.9	**154.0**

In eight out of the nine years, the rows which were cultivated on the level and which were represented by plot number one gave a higher yield per acre than the squares which were also cultivated on the level and which were represented by plot number two. In the average results for the nine years the level rows gave a total yield of 39.8 bushels and a yield of marketable potatoes of 33.0 bushels per acre per annum more than the level squares.

The squares which were hilled gave an average increase in annual yield per acre over the squares which were cultivated on the level of 7.6 bushels of total crop and of 13.1 bushels of marketable potatoes. The highest average yields per acre were produced from hills in six, and from level cultivation in three of the years of this experiment. Speaking in a general way, it might be mentioned that the seasons in which the level cultivation gave the highest results were comparatively dry.

As an outgrowth of the experiment at the College in growing potatoes in hills and on the level, a co-operative experiment was planned for the farmers of Ontario. For five years in succession potatoes were distributed from the College to those farmers who applied for the material, and instructions were given for carrying on the test in comparing the practice of hilling up potatoes as against growing them on the level. The results in each of three years were in favor of the hilled potatoes, probably due to the cool damp season, and, in each of the other two years they were in favor of level cultivation. In taking the average of the five years, during which time 170 successfully conducted experiments were reported, we find that the potatoes which were hilled gave 210 bushels, and those which were grown on the level 206.2 bushels, or about 4 bushels per acre in favor of those grown in hills.

A few years ago, high yields of potatoes per acre were claimed from what was known as the "Rural Trench System." In this method, trenches about one foot deep were made in which the potatoes were planted in loosened soil. In order to glean some information regarding the value of such a system in Ontario, an experiment was conducted for three years in succession, and an average of three tests were made in each year, or a total of nine tests. Immediately before time for planting the potatoes trenches were dug to a depth of one foot and to a width of ten inches. The trenches were made four rods in length and three feet apart from centre to centre. Each test consisted of three plots. The soil removed from the trenches in number one plot was mixed with farmyard manure at the rate of twenty tons per acre, and that of number two plot was left unfertilized. Number three plot consisted of rows twenty-six and two-fifth inches apart, and was the same as our ordinary method of cultivation previously described. After the soil was returned to the trenches, the potatoes were planted in each of the plots of the experiment to a depth of about five inches below the surface. The average results for the nine tests in three years showed the following yields of potatoes per acre per annum: Trenches with farmyard manure, 290.8 bushels; trenches without manure, 245.6 bushels; and ordinary method, 283.6 bushels. It will be understood that in the ordinary method the rows were not so wide apart as were the trenches. Had the trenches for this experiment been dug in the autumn of the year so that the frost could have acted on the soil the results might have been somewhat different. From the results which have been obtained, there appears to be but little advantage from the loosening of the soil immediately before the potatoes are planted, as described in this experiment.

When potatoes are planted after sod, it is a frequent practice to plow the land in the latter part of May to a depth of about four inches. The potato sets are dropped from twelve to eighteen inches apart in every third furrow. The land is harrowed a few times before the potato plants reach the surface. The young growth of the grass and the roots of the plants keep the soil in a friable condition and, if the soil is properly handled excellent returns are sometimes obtained from this method. The soil between the rows of potatoes should be carefully scuffled as required throughout the season to clear the land of weeds, to prevent the soil from baking, and to conserve the moisture.

EXPOSURE IN THE SUN OF SEED POTATOES AND OF FURROWS AT TIME OF PLANTING.

Many farmers will realize that it is sometimes a difficult matter to prepare the land either with a single or a double mould-board plow, and to drop the potatoes in the furrows without an exposure of both the seed and the furrows to the air and the sun before the potatoes are covered. If the seed potatoes have been taken from a comparatively dark root cellar and exposed on the ground for a time before being covered it is interesting to know just whether or not the heat and the wind will exert an injurious influence on the vitality of the seed. For the purpose of gleaning some information on this question two sets of experiments were conducted at the College in each of five years. In one experiment there was an exposure of simply the drills, and in the other there was an exposure of both the drills and the potatoes. The second experiment referred to was made up of four separate plots. The drills were made and the potatoes dropped for all the plots of the experiment, and the drills for No. 1 were closed immediately, for No. 2 in twenty minutes, for No. 3 in one hour, and for No. 4 in five hours. Each of the experiments was conducted in duplicate each year, and, therefore, comprised ten different trials. The results of these experiments showed a small amount of injury from the exposure of the drills and the tubers in the field immediately before they were covered. The average yield per acre per annum for the five years was 147.9 bushels from the drills which were covered immediately, and 146.2 bushels from the drills which were not closed until five hours after they were made and after the cut potatoes had been dropped into them.

APPLICATION OF MANURES AND FERTILIZERS.

It is practically impossible to conduct experiments with fertilizers and potatoes on any one soil which will be a definite and complete guide for farmers who wish to grow potatoes under different conditions and on varying soils. The results from fertilizer experiments are influenced by the character of the soil, the fertility of the soil, the weather conditions, the date of planting, the method of cultivation, the kind of potatoes grown, etc. Realizing the difficulties in securing all the information desirable from fertilizer experiments, work has been conducted not only at the College but on various farms throughout the Province of Ontario. The work at the College has been carried on in certain sections of the experimental grounds and over Ontario through the medium of the Ontario Agricultural and Experimental Union. We believe that this [illegible] gives the farmers decidedly better information than if the work were confined entirely to the College. Through our assistance the potato growers are thus enabled to ascertain for themselves the influence of certain fertilizers upon the potato crops grown on their own particular soils. The plan adopted furnishes a means by which the farmers may know how to use the fertilizers economically and thus receive good returns and prevent unnecessary losses. The chief value of the co-operative work is for the farmers themselves, and yet the average results give important information in supplying suggestions and in forming a general guide for the Province.

Within the past twenty-four years a large amount of experimental work with fertilizers and potatoes has been conducted at the Ontario Agricultural College. In all experiments with potatoes and fertilizers duplicate tests were carried on each year generally by using a late variety of potatoes for one set and an early variety for another set. The fertilizers were sown broadcast and mixed through the surface soil. The potatoes were planted in rows 26 2-5 inches apart, and level cultivation was practised. The potato sets were planted one foot apart in the drills. All experiments were conducted on what might be termed an average clay loam.

For five years in succession an experiment was conducted by using thirteen different fertilizers with the potato crop. In each of three years the experiment was conducted on land which was somewhat elevated, and in the other two years on rather low lying land. The test was not conducted on the same land for more than one season. Besides the separate single fertilizers such as Nitrate of Soda, Muriate of Potash, and Superphosphate, a number of brands of commercial fertilizers were used. The Nitrate of Soda and Muriate of Potash were used at the rate of 160 pounds per acre, Unleached Ashes at the rate of 800 pounds per acre, and all other fertilizers at the rate of 320 pounds per acre.

The following table gives the average results of the experiment with fertilizers and potatoes for a period of **five years**:

Fertilizers.	Percentage of Crop marketable. Average 5 years.	Bushels of total Crop per Acre. Average 5 years.
Royal Canadian	90.3	162.4
Potato Manure	88.9	146.5
Bone and Potash	89.4	146.3
Sure Growth	86.6	146.1
Superphosphate (Animal)	88.0	143.6
Reliance	88.4	142.9
Superphosphate (Mineral)	87.6	141.6
Muriate of Potash	89.3	140.5
Victor	87.7	136.7
Pure Bone Meal	86.1	132.4
Capelton	86.8	130.4
Unleached Wood Ashes	87.9	130.3
No Fertilizer	86.3	121.7
Nitrate of Soda	80.1	117.1

The Royal Canadian, Reliance, Victor and Capelton fertilizers were obtained from the Capelton Chemical and Fertilizer Company, and the Potato Manure, Bone and Potash, Sure Growth and Pure Bone Meal from the W. A. Freeman Fertilizer Company. The Unleached Ashes was a mixed product obtained at the College. According to analyses made by the Chemical Department at the College the following average composition of the fertilizers was determined: Royal Canadian, 3.83 per cent. nitrogen, 10.15 per cent. available phosphoric acid, and 5.38 per cent. potash; and Potato Fertilizer, 3.19 per cent. nitrogen, 9.25 per cent. available phosphoric acid, and 6.30 per cent. potash. The single fertilizers had the following average composition: Nitrate of soda, 15.7 per cent. nitrogen; Superphosphate, 15.4 per cent. available phosphoric acid; and Muriate of Potash, 50.9 per cent. potash. The Royal Canadian Fertilizer usually sells for $38, the Potato Fertilizer for $34.50, and the Bone and Potash and Sure Growth Fertilizers each for $32.50 per ton. In recent years the average prices for the single fertilizers per ton have been approximately $60 for Nitrate of Soda, $24.50 for Superphosphate, and $56 for Muriate of Potash. The prices paid per ton for each of the single fertilizers in the spring of 1914 were as follows: Nitrate of soda $57, Superphosphate $20, and Muriate of Potash, $43. In the autumn of 1914, however, after the European war had started the Muriate of Potash advanced to $100 per ton.

It will be seen that the Royal Canadian Fertilizer when applied at the rate of 320 pounds increased the yield slightly over 40 bushels per acre. Leaving out of consideration the cost of transportation and of application and the influence of the fertilizer on the soil for future crops, it will be seen that the increase in yield of potatoes per acre was produced at a cost of fifteen cents per bushel for the Royal Canadian, and of twenty-two cents per bushel for the Potato Fertilizer. Of the separate fertilizers it will be seen that the Animal Superphosphate gave a higher yield than the Mineral Superphosphate, the Muriate of Potash and the Nitrate of Soda, and that the latter actually gave a lower yield of potatoes per acre than the unfertilized land.

Based on the results of the experiments with fertilizers and potatoes which have been described, another test was started and was continued in the experimental grounds for a period of eight years. The methods described in the former experiment will apply equally well for this test. Four of the fertilizers were similar to those used previously, viz., Royal Canadian, Potato, Superphosphate, and Muriate of Potash. In addition, a Home Mixed Fertilizer was used and potatoes were planted on unfertilized land as a basis of comparison. The test was conducted in duplicate each year. The following table gives the average results of the sixteen tests made in the eight years:

Fertilizers.	Average percentage marketable.	Average bushels per Acre per annum.
Home Mixed Fertilizer	79.2	173.1
Royal Canadian	79.2	169.0
Potato Fertilizer	78.5	166.0
Superphosphate	76.3	162.0
Muriate of Potash	79.0	151.4
No Fertilizer	74.3	136.2

The fertilizers were used in the following quantities in pounds per acre: Muriate of Potash 160, and Superphosphate, Royal Canadian and Potato Fertilizer each 320. The Mixed Fertilizer consisted of Nitrate of Soda, Muriate of Potash, and Superphosphate in the proportion of one, one and two by weight, and was applied at the rate of 213 1-3 pounds per acre.

It will be seen from the results here presented that the fertilizers which were used in the two experiments come in the same comparative order in yield of potatoes per acre, viz., Royal Canadian, Potato, Superphosphate and Muriate of Potash. In this instance the Royal Canadian gave an average of 32.8 bushels of potatoes per acre over the unfertilized land, while in the other experiment the increase was 40 bushels per acre. An increase of over four bushels per acre per annum was obtained from 213 1-3 pounds of the Mixed Fertilizer in comparison with 320 pounds of the Royal Canadian Fertilizer.

In still another experiment extending over a period of six years cow manure applied at the rate of twenty tons per acre gave an average yield of 179.6 bushels per acre in comparison with 164.3 for the Royal Canadian, 174.3 for the Home Mixed Fertilizer, and 132.9 bushels for the unfertilized land.

In an experiment repeated in each of five years in which twenty tons of barnyard manure were compared with two tons of poultry manure in potato production it was found that the former gave an average of 17[illegible] and the latter of 172.8 bushels per acre in comparison with unfertilized land, which gave an average of 129.0 bushels per acre. The cow manure was well rotted. Both kinds of manure were applied in the early spring and were thoroughly mixed through the soil.

Farmyard manure at the rate of twenty and of five tons, and poultry manure at the rate of one ton per acre were used in each of two years for the potato crop. The average results show that the first gave an average of 162, the second of 149, and the third of 152.4 bushels per acre. Unfertilized land, under exactly the same treatment, gave an average of 133.7 bushels of potatoes per acre.

CO-OPERATIVE EXPERIMENTS WITH POTATOES AND FERTILIZERS.

There is no better way in which farmers can obtain a definite knowledge of the soil requirements on their own farms than to conduct experiments with fertilizers in a systematic way. In Ontario co-operative experiments are carried on through the medium of the Ontario Agricultural and Experimental Union. The methods of operation and the material selected for the co-operative work are based largely upon the experimental work at the College. Many of the experimenters are practical farmers who are now trained in experimental work, have good educations, some having attended our Agricultural College and all of them having a knowledge of farming operations. Great care is exercised in planning the various co-operative experiments in such a way that they can be successfully undertaken by the people who are to be benefited thereby. In every case the work is made as clear of comprehension, as definite in purpose, and as simple in method of operation as is consistent with the object in view. It has been the aim throughout to make the co-operative work as interesting, as valuable, and as instructive as possible.

An Eight-plot Experiment.—In each of the five years, from 1907 to 1911 inclusive, an experiment with fertilizers and potatoes was conducted throughout Ontario. The nitrate of soda and the muriate of potash were applied at the rate of 160 pounds, and the superphosphate at the rate of 320 pounds per acre. A home mixture, or complete fertilizer composed of one-third the amount of these fertilizers was applied at the rate of 213 1-3 pounds per acre. The Royal Canadian and the Potato Fertilizer which have given good results at the College were applied at the rate of 320 pounds each per acre. The nitrate of soda was sown on the land when the plants were about three inches in height, and all the other fertilizers at the time of sowing the seed. The advice to each experimenter was to apply 500 pounds of average cow manure per plot, the application being equal to twenty tons per acre. The cow manure was mixed with the soil to a depth of from four to five inches and the fertilizers were stirred in the soil to a depth of from one to two inches. All fertilizers and potatoes for the work were sent to the experimenters free of charge. The table here presented gives the average results of these co-operative experiments with fertilizers and potatoes carried on for **five years**, and including the tests conducted on ninety-eight Ontario farms.

Kind of Fertilizer Used.	Fertilizer per Acre.		Average Yield per Acre. 5 years, 98 tests (bushels).
	Exact Weight (lbs.).	Approximate Cost.	
Nothing	0	$ .00	129.2
Nitrate of Soda	160	4.80	153.4
Muriate of Potash	160	4.00	160.8
Superphosphate	320	3.92	158.0
Home Mixture	213⅓	4.24	166.3
Potato Fertilizer	320	5.52	167.5
Royal Canadian	320	5.60	164.5
Cow Manure	40,000 (20 tons)	6.00	174.7

The cost of each fertilizer as given in the table represents approximately, under normal conditions, the average cost per acre for the fertilizers as used in the co-operative experiments. The quotations were based on the factory prices for quantities of about one ton of each fertilizer. The twenty tons of cow manure would mean about twelve good sized loads per acre, and manure in Guelph has been selling at fifty cents per load, which is probably about the average for the Province. It is exceedingly difficult to place a price on farmyard manure as in most cases it is not purchased but is produced on the farm. Each person may place such value on the manure as he deems expedient and study the results according to his own circumstances. It should be stated that the freight on the fertilizers and the application of both the fertilizers and the manure are not taken into consideration in the foregoing statement, nor yet is there any account made of the influence of the different fertilizers and the manure upon the land after the first season.

According to the prices given for the manure and the fertilizers in the tabulated results the increased yield of potatoes was produced at a cost per bushel for the home mixed fertilizer of 11.4 cents; muriate of potash 12.7 cents; cow manure 13.2 cents; superphosphate 14.2 cents; potato fertilizer 14.4 cents; Royal Canadian 15.9 cents, and nitrate of soda 19.8 cents.

A Six-plot Experiment.—As a result of an experiment conducted at the Ontario Agricultural College in each of five years it was found that the potato fertilizer and the Royal Canadian fertilizer gave the highest yield of potatoes per acre of the different fertilizers used in the five-year experiment. In another experiment extending over a period of five years, in which several fertilizers were used, the highest yield per acre was obtained from a mixed fertilizer similar to the one used in our co-operative experiments, and which was composed of nitrate of soda, muriate of potash and superphosphate in the proportion by weight of one, one and two, and which was applied at the rate of 213 1-3 pounds per acre. This was followed by the potato fertilizer and the Royal Canadian fertilizer, each of which was applied at the rate of 320 pounds per acre. Based on these and other results an eight-plot co-operative experiment was conducted in each of five years previous to 1912, in which six different fertilizers were compared with each other, with farmyard manure, and with no fertilizer with potatoes. The home mixture, Royal Canadian and potato fertilizer again made good records.

Having before us the results of the experiments just referred to it was thought wise to start a co-operative experiment in testing different quantities of fertilizers per acre in comparison with each other, with farmyard manure alone, with farmyard manure and fertilizer, and with unfertilized land. We, therefore, placed on our list an experiment with fertilizers, cow manure, and no fertilizer with potatoes, in the spring of 1912, and we conducted experiments in 120 places throughout the Province in each of three years. We divided the number into four groups of thirty each, and used the potato fertilizer for one group, the Royal Canadian fertilizer for another, a fertilizer composed of nitrate of soda, muriate of potash, and superphosphate, in the proportion by weight of seven, nine and sixteen, for another, and a fertilizer composed of nitrate of soda, muriate of potash and superphosphate, in the proportion of one, one and two for the fourth group. Each of the first three fertilizers was applied alone at the rate of 320, 640 and 960 pounds per acre, and 320 pounds in combination with ten tons of cow manure per acre. In comparison with these, another plot received cow manure at the rate of twenty tons per acre, and one plot was left unfertilized. For No. 4 group the fertilizer was used in the same proportion, with the exception that the minimum amount was 213 1-3 instead of 320 pounds per acre. Owing to the unusual weather conditions in 1912 the potato rot was very prevalent and many of the results of the fertilizer experiments obtained could not be used on that account. There were, however, nineteen good reports of successfully conducted experiments with fertilizers and potatoes obtained in which the rot did not prove troublesome and which represented fairly well the four different kinds of fertilizers distributed. In 1913 we received in all thirty-one good reports, there being from six to ten good re for each group. In 1914 twenty-eight good reports of successfully conducted experiments were received, there being exactly seven good reports for each separate test. We, therefore, have for the three years seventy-eight good reports of successfully conducted experiments.

The following table gives the average results of the various tests of each of the four fertilizers, and also the average results of the four fertilizers comprising in all seventy-eight separate tests conducted during the **three years:**

Fertilizers and Manures.	Fertilizer per Acre.		Yield of Potatoes per Acre (bushels).				
	Weight (lbs.).	Cost.	A. Potato Fertilizer. 3 years, 17 tests.	B. Royal Canadian Fertilizer. 3 years, 19 tests.	C. Home Mixture. 3 years, 22 tests.	D. Home Mixture. 3 years, 20 tests.	A.B.C.D. Average 4 Fertilizers. 3 years, 78 tests.
		$ c.					
1. No Fertilizer....	0	00	158.3	119.5	106.7	142.8	131.8
2. Fertilizer.......	320	6.31	179.5	139.9	130.8	*165.9	*154.0
3. Fertilizer.......	640	12.62	187.3	152.6	143.7	180.4	166.0
4. Fertilizer.......	960	18.93	196.0	169.0	160.0	190.4	178.9
5. Fertilizer....... Cow Manure....	320 10 tons	9.31	198.0	166.5	160.8	194.1	179.9
6. Cow Manure....	20 tons	6.00	203.0	166.0	163.8	194.3	181.8

It should be understood that the different fertilizers were tested on different farms. It is, therefore, not fair to make a close comparison of one fertilizer with another. The results are valuable in showing the yields from the different amounts of fertilizer in comparison with the yield from no fertilizer, from cow manure and from a combination of cow manure and fertilizer. It will be seen that on the average there was an increase in the yield of potatoes per acre of 22.2 bushels at a cost of 28 cents per bushel from 320 pounds of fertilizer; of 34.2 bushels at a cost of 37 cents per bushel from 640 pounds of fertilizer; and of 47.1 bushels at a cost of 40 cents per bushel from 960 pounds of fertilizer. The yield of potatoes per acre increased as the amount of fertilizer used became greater. From a study of these results it would seem as though the first 320 pounds of fertilizer increased the yield 22.2 bushels, the second 320 pounds 12 bushels, and the third 320 pounds 12.9 bushels per acre. It will also be observed that the twenty tons of cow manure per acre increased the yield of potatoes exactly 50 bushels over no fertilizer or 1.9 bushels per acre over the combination of ten tons of cow manure and 320 pounds of fertilizer per acre. The amount of fertilizer for Plot 2 in Group D consisted of 213 1-3 instead of 320 pounds per acre and was identical with the home mixed fertilizer used for five years throughout Ontario in experiments conducted on ninety-eight farms, the results of which have already been presented. This fertilizer increased the yield of potatoes 23.6 bushels at an average cost of 18 cents per bushel.

Each experimenter was asked to conduct h fertilizer test on the average soil of his farm. The results here presented are, therefore, for average soils of Ontario. On some farms the fertilizers paid better than they did on others. Every farmer who wishes to use fertilizers should become as familiar as possible with the requirements of his own particular farm. The results here given show in a general way the records of these fertilizers under the varying conditions of the farm lands of the Province, and should furnish valuable suggestions.

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*Fertilizer D was used at the rate of 213⅓ instead of 320 pounds, and at a cost of $4.24 instead of $6.31 per acre.

SPRAYING WITH BORDEAUX MIXTURE FOR THE PREVENTION OF LATE BLIGHT, EARLY BLIGHT AND TIP BURN.

The late blight is considered the most destructive disease of the potato crops of this country. It is a parasitic fungus which develops on potatoes in late summer, and is particularly disastrous in moist seasons, and in low lying, damp locations. The first indication of the disease is the appearance on the leaves of brownish spots which rapidly grow darker in color, causing the leaves to curl and crumple, and in some instances to decay and produce an offensive odor. The brownish spots on the lower surface of the leaves show a delicate downy coat and soon form white bands around the borders. The spores which are produced in the spots on the leaves are said to be scattered by wind and water, thus conveying the disease to other plants. It is supposed that some of the spores of the late blight finally enter the potatoes, and that they frequently cause brownish spots under the skin and sometimes a dry rot of the tubers.

Bordeaux mixture is supposed to be efficacious as a preventative against the late blight (Phytophthora infestans), the early blight (Alternaria solani), and the tip burn, and in repelling flea beetles, and also if used in conjunction with Paris green or lead arsenate in killing the Colorado potato beetles. For best results, however, it is necessary to spray early in the season, to do the work thoroughly and to repeat the operations as required until the danger of trouble is past.

All the varieties of potatoes under experiment at the College have been sprayed with Bordeaux mixture from three to five times each year since 1906. Previous to 1906 different fungicides such as Bordeaux mixture and Bug Death were used. In a duplicate experiment conducted in 1901 potatoes which were sprayed with Bordeaux mixture gave an average of 288.1, and those which were left unsprayed an average of 268.4 bushels per acre.

In 1907 an experiment was started in spraying potatoes at the College with two preparations of Bordeaux mixture. Three varieties of potatoes, an early, a medium, and a late were used for each preparation. Each test consisted of five plots as follows: 1, 2, 3, and 4, plants sprayed on top three, four, five and six times respectively; and 5, plants sprayed on top and underneath the leaves three times. In 1909 an extra plot which was left unsprayed was added, thus making six plots in each test, and a better basis of comparison.

One preparation of Bordeaux mixture was made according to the usual formula of 4-4-40, more fully described as follows:

Copper Sulphate (Bluestone)	4 pounds.
Unslaked Lime	4 pounds.
Water	40 gallons.

Stock solutions were made by suspending in a barrel one coarse bag containing twenty-five pounds of bluestone which was allowed to dissolve in twenty-five gallons of hot water, and by dissolving in another barrel twenty-five pounds of unslaked lime in twenty-five gallons of cold water. These two solutions were kept separately until required for the different sprayings. In preparing the Bordeaux for use the materials were mixed in the proportions of one gallon of the bluestone solution, one gallon of the lime solution, and eight gallons of water.

The other preparation of Bordeaux mixture was made in exactly the same way with the exception that six instead of four pounds of bluestone were used. The formula, therefore, of this preparation was 6-4-40.

Spraying Potatoes in different years in the Experimental grounds at the Ontario Agricultural College.

The experiment was conducted from 1907 to 1913, inclusive, making in all seven years. On the average of the whole period the first spraying in the season took place as follows: plot 4 on July 3rd, plots 3 and 5 on July 17th, plot 2 on July 31st, and plot 1 on Aug. 14th. Two weeks were allowed between each two sprayings. Care was taken to do the work thoroughly in the various years of the experiment. The sprayings were made with a one wheel, four nozzle, hand sprayer from 1907 to 1909, inclusive, with watering cans equipped with special nozzles for making a fine spray in 1910, and with a two wheel, four row, horse sprayer with nozzles arranged for spraying above and below the leaves from 1911 to 1913, inclusive. In the four years, from 1907 to 1910, however, a knapsack with the assistance of a wooden rake was used for spraying the potatoes both above and below the leaves. In the last three years of the experiment all sprayings were accomplished satisfactorily with a horse machine and the nozzle attachments. For each application the potatoes which were sprayed both above and below the leaves required about twice as much material as those which were sprayed only on top.

In the seven years of this experiment rot occurred in 1910 and in 1912, but in none of the other years. The results, therefore, will be presented separately for the years in which there was no rot, and for the years in which rot occurred. The sprayings on No. 4 plot were not complete in every year and consequently the results from that plot are omitted.

The following table gives the average results of spraying potatoes with Bordeaux mixture in the years 1907, 1908, 1909, 1911 and 1913:

Number of Sprayings.	Portion of Plants Sprayed.	Average Percentage of Green Vines on Sept. 6th. 18 tests.	Average Weight of 30 Largest Potatoes per Plot (lbs.). 18 tests.	Yield of Potatoes per Acre (bushels).			
				Marketable.		Total.	
				3 years, 18 tests.	5 years, 30 tests.	3 years, 18 tests.	5 years, 20 tests.
0	0	60	10.17	151.1	*....	179.1	*....
3	Top	67	10.57	156.3	169.0	184.1	200.2
4	Top	69	10.65	159.7	173.4	189.0	205.6
5	Top	71	10.78	167.3	179.9	195.2	210.8
3	Top & Bot'm	77	11.48	169.8	183.9	197.7	214.7

These results give the averages of a large amount of experimental work, including early, medium and late varieties of potatoes, and two different spraying preparations in each of five years. The three years' experiment is made up of 18, and the five years' experiment of 30 distinct tests.

Even in those years in which no rot occurred there was on the average an actual increase in yield of potatoes per acre from spraying with the Bordeaux mixture. It will be seen that the sprayings had an influence not only in increasing both the yield of marketable and total crop per acre, but also in prolonging the growth of the plants and in increasing the size of the potatoes. The results of the experiment both for three and for five years show the highest yields per acre from the plots which received three sprayings, both above and below the leaves. It is

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*The unsprayed plot was not included in the test until 1909.

interesting to know that spraying machines are now made which will give satisfactory results in spraying, both above and below the leaves, and that three applications made in this way are likely to give better results than five applications in which the spraying material is conveyed to the tops of the plants only.

Of the two spraying materials used the 6-4-40 solution gave slightly better results than the 4-4-40 formula. Although an early, a medium and a late variety were used each year with each of the solutions the varieties were not the same, and this fact might have had some influence on the comparative results from the two preparations. Further experiments would need to be conducted before conclusions could be obtained regarding the comparative value of the two spraying materials.

As has already been stated a small amount of rot occurred in 1910 and a large amount in 1912. In the former year the percentage of rot which developed by the end of November in connection with the experiment here referred to was as follows: Unsprayed 5, sprayed three times 1, four times 1, five times 1, and sprayed both above and below the leaves 2. As was stated previously, the plot which was sprayed both above and below the leaves three different times received the treatment earlier than the plot which was sprayed only on top of the leaves on three separate occasions. It will be seen that while the spraying did not entirely eliminate the rot it reduced it greatly in every instance. In 1912 all the rotten potatoes in each plot were carefully counted, but unfortunately the number of sound potatoes was omitted in that year, and it is, therefore, impossible to give the percentage of rot according to number. In 1912, however, the spraying material, whether used on top of the leaves for three, four or five times, or both on top and below the leaves for three times, had practically no influence in reducing the amount of rot. As the spraying with Bordeaux mixture was done carefully and in different ways it seems evident that the rot in that year was not caused by the late blight.

Another experiment in spraying for late blight was started in 1907 and was conducted for seven years in succession. At the beginning the experiment consisted in spraying both an early and late variety two, three, four, five and six times. In 1909 an unsprayed plot was added to each test. The first sprayings in the season were made from June 26th to July 5th according to season, the average of the seven years being July 3rd. Two weeks were allowed between each two sprayings. The Bordeaux formula used for this experiment consisted of bluestone 6 pounds, lime 4 pounds, and water 40 gallons. For information regarding method of spraying, etc., the reader is referred to the description given in the last experiment. In all of the years, excepting 1910 and 1912, the weather conditions were favorable for the growth of healthy potatoes, no rot occurring in those years. In the average results for the three years in which there was no rot and in which the unsprayed plots were used as a basis of comparison the following average yields in bushels per acre from the different number of sprayings were obtained: two sprayings 181.7, three sprayings 195.9, four sprayings 200.4, and five sprayings 193.0. The unsprayed plot gave an average of 170.6 bushels per acre. It will, therefore, be seen that the highest returns were obtained from four sprayings, which gave an increase of practically thirty bushels per acre over the unsprayed plot. The results from the plots which should have received six sprayings were incomplete in one of these years, hence the average for the period cannot be presented. In the average for the five years' experiment in which there was no rot the results from the different sprayings in yield of potatoes per acre per annum were as follows: two sprayings 191.6, three sprayings 202.8, four sprayings 214.6, and five sprayings 209.7.

In 1910 both the rotten and sound potatoes of each of the varieties and from each of the plots belonging to this experiment were carefully counted. The average results in percentage of rot, yield per acre, etc., for this year are presented as follows:

Number of Sprayings.	Dates of Sprayings.						Average Date of Maturity. October.	Average Yield per Acre Sound Potatoes (bushels).	Average Percentage of Rot in Whole Crop.
	July.		August.			Sept.			
0...........	..	..	..	..	..	..	7	111.0	32
2...........	5	19	..	..	..	..	11	117.5	31
3...........	5	19	2	..	..	..	12	143.0	18
4...........	5	19	2	16	..	..	13	137.3	15
5...........	5	19	2	16	30	..	15	152.0	8
6...........	5	19	2	16	20	13	17	162.0	3

The results show that as the number of sprayings increased the date of maturity was extended, the average percentage of rot was decreased, and with one exception the average yield per acre was increased. The two varieties of potatoes used in this experiment were more subject to rot than the majority of the six varieties used in the previous experiment, which accounts for the large percentage of rot in the former as compared with the latter.

In 1912, when the rot was prevalent, the number of diseased potatoes was carefully counted in the autumn, but the number of sound potatoes was not determined, and consequently the percentage of rotten tubers cannot be tabulated as in the former test. It might be stated, however, that in 1912 none of the sprayings showed a beneficial influence in the reduction of rot. As in the case of the previous experiment, it seems apparent that the rot was not caused by the late blight in 1912.

THE RESISTANCE OF POTATOES TO ROT.

Within the past twenty-six years the potato crop was practically free from rot at the Ontario Agricultural College in each of sixteen seasons. Rot was somewhat troublesome in the years 1899, 1902, 1905, 1906 and 1910, and it was quite serious in 1897, 1903, 1904, 1912 and 1915. It is interesting to note that in 1898 and 1913 there was practically no rot in the potato crops, even though rot had been very prevalent in the two preceding years. As a number of varieties of potatoes were grown under uniform conditions at the College the results of the comparative resistance or susceptibility to rot forms an interesting study. Since 1902 the varieties were sprayed with Bordeaux mixture as a fungicide, and with either lead arsenate or Paris green as an insecticide, from three to four times, with the exception of the years 1904, 1905 and 1906, when Bug Death, which was claimed to be a fungicide as well as an insecticide was used in the dry condition instead of Bordeaux mixture and Paris green. The spraying was done with a one wheel, four nozzle, hand-sprayer from 1907 to 1909, inclusive, with watering-cans in 1910, and with a two wheel, four nozzle, horse sprayer from 1911 to 1915, inclusive.

Twenty varieties of potatoes were grown in each of the years 1903, 1904, 1905, 1906, 1910, 1912 and 1915, when rot was more or less prevalent. One other important variety was included in the test for six of these years starting in 1904, and another variety for five of the years starting in 1905. Very careful determinations were made of the number of sound and of rotten potatoes at the time of harvesting, and also after being stored in the winter. Unfortunately, some of the determinations in the crop of 1912 were omitted, and the results for that year cannot be tabulated.

The following table gives the color of the potatoes, the average number of days to mature, and the average percentage of potatoes partially or wholly rotten in the crops produced in each of **six years,** and including twenty-two varieties:—

Varieties.	Color.	Average number of days to mature (6 years.)	Average percentage of rotten potatoes 6 years 1903-4-5-6-10-15.
1. Davies' Warrior	White	115	(a) 2.87
2. Extra Early Eureka	White	94	(b) 4.19
3. Stray Beauty	Red	89	4.61
4. Early Pinkeye	Pink and white	89	5.33
5. Irish Cups	Rose	109	8.07
6. Lightning Express	Pinkish white	94	13.77
7. Sir Walter Raleigh	White	109	15.29
8. Six Weeks	Rose	91	18.44
9. Empire State	White	110	19.99
10. American Wonder	White	108	20.39
11. New White Beauty	White russet	108	20.71
12. Rural New Yorker No. 2	White	111	21.21
13. White Elephant	Rose and white	108	22.18
14. Burpee's Early Extra	Rose and white	108	23.44
15. Early Fortune	Rose	93	23.75
16. Rose's New Invincible	Rose	108	24.35
17. Carman No. 1	White	109	25.02
18. Pearl of Savoy	Light rose	110	25.06
19. Rose of the North	Rose	102	25.48
20. Early Ohio	Rose	92	26.58
21. Beauty of Hebron	Rose	108	27.52
22. Early Rose	Rose	104	27.68

(a) Average 5 years, (b) Average 4 years.

The average percentage of rot of the varieties here reported for each of the six years included in the attached table was as follows: 1903, 26.3; 1904, 40.2; 1905, 5.7; 1906, 5.0; 1910, 2.9; and 1915, 34.7. The amount of rot for the twenty-two varieties, therefore, in the average of these six years in which the rot was prevalent would be practically 18 per cent. The varieties of potatoes which have been grown at the College within the past twenty-six years have had an amount of rot equivalent to an average of probably 6 or 7 per cent. per annum.

Very careful records of the rainfall at the College have been kept by the Department of Agricultural Physics in each of the past sixteen years. In comparing the amount of rainfall during the months of July, August and September with the amount of rot in the potato crop in each of the past sixteen years some interesting information has been obtained. The annual amount of rainfall for the three months referred to for the eight years in which there was no rot was 7.1 inches, for the four years when there was a moderate amount of rot 9.8 inches, and for the four years in which the rot was abundant 11.7 inches. The amount of rainfall, therefore, appears to have a very marked influence in making conditions favorable or unfavorable for the development of rot.

In the average results of all the varieties grown in either four or five years in which rot was more or less prevalent the Davies' Warrior, gave the lowest percentage of rotten potatoes. According to the results here presented Davies' Warrior, Irish Cups, Sir Walter Raleigh, and Empire State were the freest from rot of the late varieties, and Extra Early Eureka, Stray Beauty and Early Pinkeye of the early varieties. Of the eight varieties freest from rot five were early in reaching maturity, and of the eight varieties most susceptible to rot two were early in maturing. It is interesting to note that the three varieties least subject to rot included one of the latest and one of the earliest varieties in the list. Some of the varieties which were most susceptible to rot, such as the Early Ohio, the Beauty of Hebron, and the Early Rose are well known, and have been grown considerably throughout Ontario.

The following table gives the percentage of rot of a few characteristic varieties in each of **four years:**

Varieties.	Percentage of Rotten Potatoes.				
	1905.	1906.	1910.	1915.	Average 4 years.
Davies' Warrior	.83	1.23	.72	12.09	3.72
Extra Early Eureka	.35	.77	0	15.27	4.10
Stray Beauty	0	.69	0	17.34	4.51
Early Pinkeye	0	.44	0	20.75	5.30
Early Rose	.85	8.70	23.06	36.89	17.38
Pearl of Savoy	8.24	11.98	12.83	45.98	19.76
Early Ohio	1.22	6.58	0	75.46	20.82
Carman No. 1	35.43	.70	.29	47.07	20.87

It will be seen that the very early varieties such as the Stray Beauty and the Early Pinkeye were entirely free from rot in 1905 and in 1910, and that the early potatoes such as the Extra Early Eureka and the Early Ohio were free from rot in 1910. It might be noted that the Davies' Warrior, which is a late maturer, was the only potato entirely free from rot out of one hundred and eight varieties grown in 1904. The Early Rose, which is now a medium late potato, had a comparatively large percentage of rot in each of the years 1906, 1910 and 1915. Fully one-third of the Carman No. 1 rotted in 1905, but the seed taken from this crop produced potatoes in 1906 which were almost free from the disease. The Pearl of Savoy rotted considerably in each year in which the disease was prevalent. It is apparent that very early varieties escape the rot almost entirely in some seasons. In other years, however, while a few of the early varieties are comparatively free from rot others are affected very seriously. These points are illustrated by the results of the Extra Early Eureka and the Early Ohio varieties.

There are still prominent varieties of potatoes in Ontario which we have not been able to include in the foregoing groups, and which will receive special consideration at this time. In the tests of three years in which rot occurred the Green Mountain had on the average three times, and the Delaware twice as much rot as the Stray Beauty, and the first named sort had slightly less rot than the Rural New Yorker No. 2. The Green Mountain and the Delaware varieties have several characteristics in common and sometimes one variety is sold for the other. In the years 1910 and 1915 the average percentage of rot of some of the varieties was as follows:—Davies' Warrior 6.4, Extra Early Eureka 7.6, The Hustler 7.6, Eldorado 8.2, First Choice 8.3, Solanium Commersoni Violet 9.5, Delaware 10.5, Irish Cobbler 13.6, Pearl of Savoy 29.4 and Early Rose 30.0. The Extra Early Eureka and the Irish Cobbler varieties resemble each other in certain characteristics and some people claim that they are identical. In the years 1910, 1912 and 1915, however, when these varieties were grown under uniform conditions the Irish

Cobbler had the largest amount of rot in each year. In freedom from rot in 1915 Dalmeny Acme came first, Late Faction fourth, Dooley eighth, Statesman fifteenth, Pan-American thirty-eighth, Wonderful forty-fifth, and Carman No. 1 eightieth on the list of varieties.

In each of the past six years we secured seed potatoes of the Empire State variety from Muskoka, where they have been grown on the same farm for twenty-three years continuously. The crops produced from the Muskoka seed potatoes purchased in the years 1910, 1912 and 1915 had about one-quarter less rot than those produced from the Empire State variety grown at the College continuously for the past twenty-six years.

In the spring of 1913 six lots of potatoes were secured from different localities in Ontario, and in the spring of 1915 the same varieties were again obtained from exactly the same sources. In 1915 six plots were planted with the second years' crop from the 1913 seed, and six other plots with the seed purchased from the outside localities. The average percentage of rot in the crops produced was 10.9 in the former and 9.9 in the latter.

An experiment in hilling and level cultivation for potatoes was conducted in duplicate in each of four years in which rot occurred. The average results of the eight tests showed 27.7 per cent. rot from the level cultivation, and 21.8 per cent. rot from the hills.

Each of six varieties of potatoes were planted on four separate dates in 1910 and in 1915. The first planting took place on May 31st, and the last on July 12th, and two weeks were allowed between each two dates of planting. The following table gives the average percentage of rot of the six varieties planted on different dates in each of two years:—

Dates of Planting.	Percentage of Whole Crop Rotten.	
	1910.	1915.
May 31	1.18	33.43
June 14	4.27	27.28
June 28	5.45	13.88
July 12	22.76	3.71

It will be seen that as the date of planting advanced the percentage of rot in the whole crop increased in 1910 and decreased in 1915. This was true in the case of each variety as well as in the average of the six varieties, of which two were early, two medium and two late. In 1915 the six varieties were also planted on May 3rd and on May 17th, and the average percentages of rot were 22.8 and 26.7 respectively. It will, therefore, be seen that in 1915 the maximum amount of rot was developed from the planting of the 1st of June.

In connection with these results it is interesting to study the amount of rainfall at the College in each of four of the growing months in 1910 and in 1915. The total number of inches of rainfall in each of the four months in the years referred to was as follows: 1910, June .78, July 1.89, August 3.18, and September 3.29; and 1915, June 2.27, July 5.87, August 6.16, and September 3.92. It will, therefore, be seen that the rainfall undoubtedly had a marked influence in the amount of rot produced in the potatoes grown from the different dates of planting.

Potatoes of different stages of maturity which were planted under uniform conditions in each of the years 1910 and 1915 showed but little difference in rot susceptibility.

ROT IN STORED POTATOES OF DIFFERENT VARIETIES.

In each of the eight years in which rot occurred the number of decayed tubers of each variety was counted, not only in the field at the time of digging, but also in the cellar when the potatoes were stored. As there is so little information in print regarding the comparative amount of rot in the field and in the stored potatoes of different varieties the matter will be referred to in detail as it relates to a few characteristic kinds for the past year. The eighty-four varieties of potatoes which were grown under similar conditions in 1915 were dug, the number of rotten potatoes counted, and the sound tubers stored in the basement of the Experimental Barn in September. The potatoes were sorted in October, and again in January, and the number of rotten potatoes was carefully determined on each occasion. In the average of the eighty-four varieties the amount of rot at the time of digging was 17.5 per cent., at the time of sorting the potatoes in October 4.6 per cent., and at the time of examining the stored potatoes in January 3.2 per cent. The winter temperature of the potato cellar was kept at about 33 degrees to 35 degrees Fahrenheit.

The following table gives the percentage of rot of each of fourteen characteristic varieties of potatoes when the tubers were examined at each of three different times:—

Varieties.	Percentage of Crop Rotten.			
	In the Field. September.	In the Barn. October.	In Storage. January.	Total.
Davies' Warrior	3.32	4.98	3.79	**12.09**
Extra Early Eureka	10.45	2.49	2.33	**15.27**
Irish Cups	5.89	5.69	4.87	**16.45**
Stray Beauty	9.36	5.26	2.72	**17.34**
Solanium Commersoni Violet	3.31	3.97	11.74	**19.02**
Irish Cobbler	13.83	6.07	6.96	**26.86**
Early Puritan	18.34	10.19	4.59	**33.12**
Empire State	29.05	5.87	3.35	**38.27**
Green Mountain	30.84	5.80	3.82	**40.46**
Pearl of Savoy	35.43	4.34	6.16	**45.93**
Carman No. 1	39.63	1.86	5.58	**47.07**
Derby's Early	35.14	12.89	8.28	**56.31**
Early Fortune	42.59	9.18	6.71	**58.48**
Early Ohio	45.71	22.25	7.50	**75.46**

The varieties here referred to were again examined for percentage of rotten potatoes on February 19th, 1916, and it was found that the rot had apparently ceased in five of the varieties, and only in three kinds did it amount to more than one-half of one per cent. The Solanium Commersoni Violet had 2.3 per cent. of rot, this being the largest percentage found in any of these varieties when examined on February 19th.

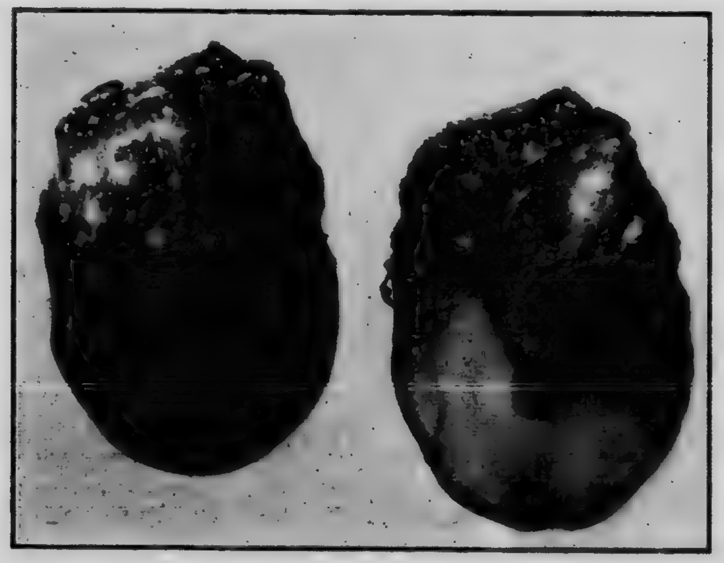
The results show that rot occurred not only before these potatoes were dug, but also when they were in winter storage. The amount of rot of the Davies' Warrior and of the Irish Cups was fairly constant in the three examinations. In the Extra Early Eureka, however, the greatest amount of rot was found at the time of digging the potatoes in September, and in the Solanium Commersoni Violet at the time of examining the stored potatoes in January. It is interesting to compare the percentage of rot in the Davies' Warrior and in the Early Ohio on each of the three examinations. The Extra Early Eureka and the Irish Cobbler varieties have several points in common, and yet it will be seen that the Irish Cobbler had a higher percentage of rot than the Extra Early Eureka at each time of examination. These results coincide with our observations of these two varieties in other years.

According to investigations made by Prof. D. H. Jones, Bacteriologist at our College, the rot occurring in these potatoes produced in 1915 was caused partly by the Fusarium Wilt and partly by the bacterial disease known as Black Leg. These two diseases appeared to be somewhat prevalent in Ontario in the wet autumn of 1915.

Bacterial Soft Rot of Growing Potatoes.

TREATMENT FOR THE PREVENTION OF ROT IN STORED POTATOES.

As has been stated an unusually large amount of rot occurred in the potatoes in 1912. Just how much damage rot would do in the stored potatoes in the following winter was not definitely known. The question as to what could be done to check the development of the disease in the stored potatoes was considered. An experiment was started by setting aside eight lots of one hundred apparently



Fusarium Dry Rot of Stored Potatoes.

sound tubers each from an early, a medium, and a late variety of potatoes. In addition to these, eight lots with ten slightly decayed tubers each of the three varieties of potatoes were selected. On November seventh each of the two groups of potatoes of the three varieties were treated. Lots No. 1, 2, 3 and 4 were immersed for twenty minutes in solutions made as follows: No. 1, one pint of formalin in forty-two gallons of water; No. 2, four pounds of hydrated lime to forty gallons of water; No. 3, one gallon of commercial lime sulphur to thirty gallons of water, and No. 4, four pounds of bluestone to forty gallons of water. Lots No. 5, 6, and 7 were dusted as follows: No. 5 with hydrated lime, No. 6, with unslaked finely ground lime, and No. 7, with slaked lime. The 8th lot was left untreated. The potatoes were kept in the potato cellar during the winter at a temperature of about 33 degrees to 35 degrees F. The potatoes were examined every month until the seventh of June and on each examination the rotten potatoes were counted and removed. The experiment was repeated in a similar manner with the crop of 1915 excepting that the treatments were not made until the twenty-third of November. Notes were taken of the rotten potatoes removed from the different lots on December 23rd, 1915, and January 24th and February 23rd, 1916. The experiment, therefore, was conducted six times with the potatoes which were apparently sound and also with the potatoes which had started to decay, making a total of twelve separate tests.

The following table gives the average results from treating three varieties of potatoes in each of two years by using each of two selections of tubers, and including in the experiment about five thousand potatoes.

Treatments.	Materials.	Average percentage of Rotten Potatoes. 1912 and 1915.		
		Condition of Potatoes when placed in Storage.		Average two groups (12 tests.)
		Apparently sound (6 tests.)	Slightly decayed (6 tests.)	
Immersed for 20 minutes.	1. Formalin Solution	1.7	58.3	30.0
	2. Hydrated Lime Solution	1.5	66.5	34.0
	3. Lime Sulphur "	2.3	66.7	34.5
	4. Bluestone "	21.2	70.0	45.6
Dusted.	5. Hydrated Lime	.8	40.0	20.4
	6. Unslaked Lime........	2.5	41.7	22.1
	7. Slaked Lime	2.8	55.0	28.9
——	8. Untreated	4.5	58.3	31.4

The results show that in the potatoes which were selected and which had indications of being sound, but which apparently possessed the germs of disease at the surface, developed rot from less than one to over twenty-one per cent. The immersion in the bluestone or copper sulphate solution evidently injured the tissues in the skin of the potato without killing the germs of the disease sufficiently to prevent the development of the rot, as the potatoes so treated decayed much more readily than those which were left untreated. This was shown in the individual tests as well as in the average results. The sprinkling with the hydrated lime, however, seemed to have a wholesome influence in checking the disease. This is seen not only in the potatoes which were apparently sound but also in those which were slightly decayed at the time that the treatment took place. These results seem to indicate that in a season when rot is prevalent the disease may be checked somewhat by sprinkling the potatoes with hydrated lime before placing them in winter storage.

TREATMENT FOR THE POTATO SCAB.

(*Oospora scabies.*)

The potato scab is a fungus disease which causes rough, darkish brown spots on the surface of the potatoes. Botanical investigators inform us that the spores of the common scab may be conveyed to the land with farmyard manure as well as with potatoes, and that the spores may live in the land for several years and still have the power of producing the fungus. The amount of scab seems to increase with the amount of vegetable matter in the soil, and especially with applications of fresh manure or with alkaline fertilizers to the land.

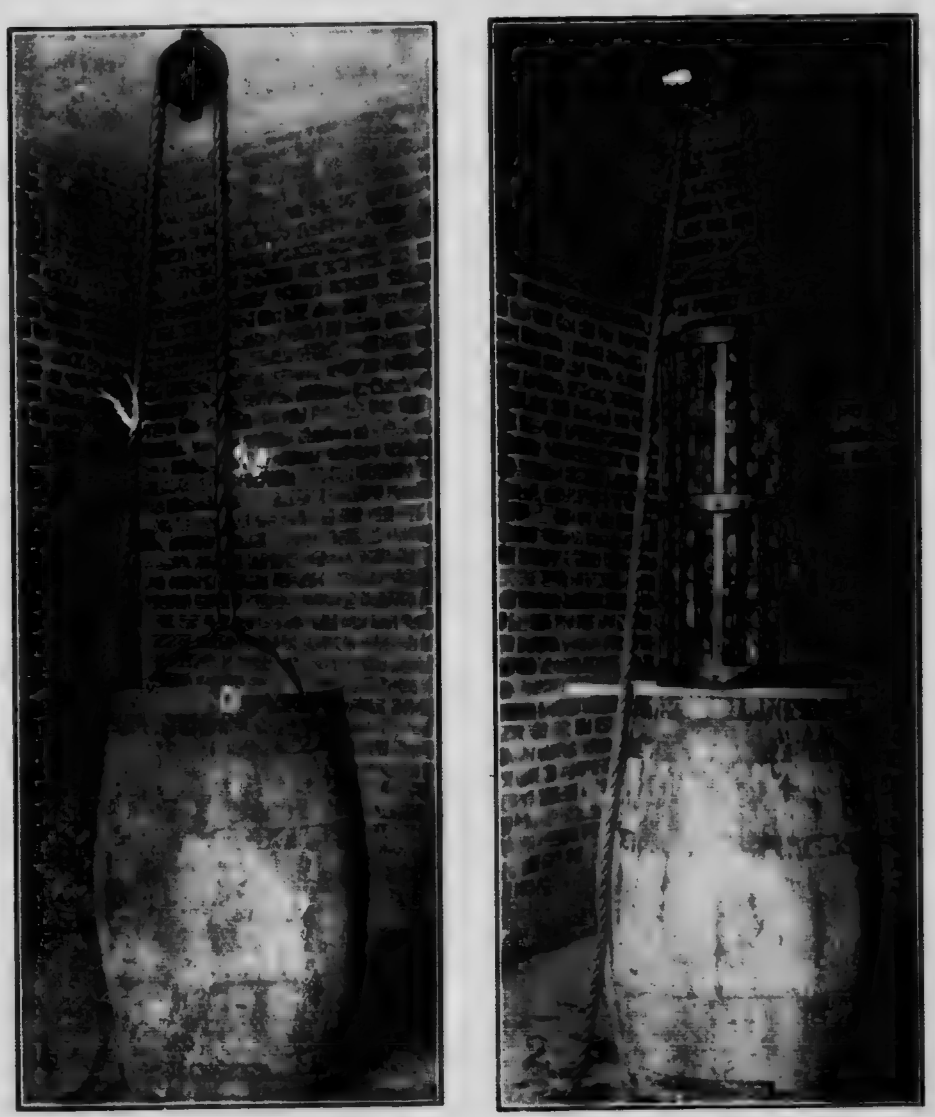
In each of ten years an experiment was conducted at the College in treating potatoes for the scab. The potatoes for one plot were left untreated, and those for another plot were treated with corrosive sublimate (mercuric bichloride) a poisonous material. The last treatment was prepared by dissolving two and one-quarter ounces of corrosive sublimate in two gallons of hot water, and after an intérval of ten or twelve hours diluted with thirteen gallons of water. The whole potatoes were immersed in this solution for one and one-half hours, then spread out to dry, and cut and planted in the usual manner, in comparison with others which were left untreated.

In each of the past five years, in addition to the corrosive sublimate, another plot was added for testing the potatoes which had been treated for the scab by the formalin method. This consisted in soaking the seed potatoes for two hours in a solution of formalin (40 per cent. formaldehyde) made by mixing one pound of the formalin with thirty gallons of water.

The experiment in testing the corrosive sublimate for ten years, and both the corrosive sublimate and formalin for five years was conducted in duplicate each season. Generally two varieties of potatoes were used for the two tests, but occasionally one variety was used for both tests. In the average results for the ten years it is interesting to note that the average yield of potatoes per acre per annum was 145 bushels from the seed which was left untreated, and it was also 145 bushels from the seed which was treated with corrosive sublimate. This test, therefore, showed that the corrosive sublimate had no injurious effect on the seed. In the experiment for five years the seed which was treated with the formalin gave practically the same average yield of potatoes per acre as the seed which had been treated with the corrosive sublimate. In some of the years both of the treatments reduced the amount of scab in the potatoes to a considerable extent, and in other years the reduction was not very pronounced. This is probably due to the fact that the land received manure either in the autumn or in the spring previous to the planting of the potatoes. The manure was purchased in the City of Guelph and would probably contain spores of the scab conveyed to the manure by means of peelings of scabby tubers. Of the two treatments under test the immersion of the seed in the diluted formalin was perhaps the most effectual in reducing the percentage of scab in the crop of potatoes produced.

Some years ago an experiment was conducted in comparing flour of sulphur and corrosive sublimate for the prevention of scab. The flour of sulphur, however, did not give as good satisfaction as the corrosive sublimate.

In order to grow potatoes free of scab it would be well to plant clean seed on land which had not grown potatoes or roots for four or five years previously. If farmyard manure is used it should be free of spores obtained from scabby tubers, peelings, etc., and applied to the land at least one year previous to the planting of the potatoes. Alkaline fertilizers such as wood ashes and lime should also be avoided. Even though seed potatoes are apparently free of scab it would be safer to immerse the whole seed potatoes for two hours in a solution of one pound of formalin and thirty gallons of water. After the potatoes have been treated care should be taken that they are not again contaminated with spores from dirty bags, boxes, baskets, etc.



Method of Treating Potatoes for Scab by Immersion in Formalin Solution. (1) Potatoes being immersed for two hours; (2) Potatoes draining after immersion.

SUGGESTIONS FOR ERADICATING POTATO DISEASES FROM AN ONTARIO FARM.

It is advisable to grow the best potatoes which are resistant to rot. A judicious system of manuring and a long rotation of suitable crops assist greatly in preventing the spores of a number of diseases from reaching the potatoes. Seed potatoes should always be examined with the object of selecting those which show no signs of disease such as scab of any kind, abnormal colorings, and the presence of rot. Immersion in formalin solution to kill the spores of disease on the surface of the tubers is a further precaution. Each person cutting seed potatoes should have two knives and a dish containing a twenty-five per cent. solution of formaldehyde. When a tuber showing signs of rot is cut the potato should be discarded, and the knife which was used should be exchanged for the one in the solution before the next potato is cut. It is a good practice to remove and discard a thin slice from the stem end of each tuber, even though the potato shows no signs of rot.

Spraying the crop with Bordeaux mixture and with Paris green or lead arsenate, or both, insures against blight, protects against insects, stimulates and prolongs growth, and increases the yield per acre and the percentage of marketable potatoes.

A thorough roguing of the growing crop once or twice during the summer is one of the most effectual ways in ridding diseases from the potatoes. This operation would insure the immediate removal and destruction of plants showing signs of such diseases as Black Leg, Rhizoctonia, Fusarium Wilt, Spindling-sprout, Mosaic, Curly Dwarf and Leaf Roll. The removal of these weak and unhealthy plants tends to develop the uniformity of the potatoes and to increase the value of the crop. If all the potatoes on the farm cannot be rogued the first year, thorough work should be carried out on a sufficiently large patch to insure an adequate supply of good seed for the year following, when the roguing can be accomplished more easily. Potato growers sometimes go through their fields and remove all plants which are not true to variety. When roguing is done with the double object of eradicating diseases and of purifying the variety, decided advantages are sure to follow.

The writer believes that if care and good judgment are exercised in carrying out the suggestions here indicated an Ontario potato grower may hope to clear his potato crops almost entirely from diseases within a comparatively short time.

ONTARIO FREE FROM SOME SERIOUS POTATO DISEASES.

Ontario is, indeed, fortunate in being free from some of the serious potato diseases which are prevalent in Europe, amongst which two are here mentioned.

The Potato Canker.—What is known as Potato Canker or Potato Wart is a fungus disease forming warty excrescences on the tubers which change from a greenish white to a dark color. It has spread rapidly in several of the European countries, but it has not obtained a foothold as yet in either Canada or the United States, although it was found in Newfoundland by Dr. H. T. Gussow in 1909.

The Powdery Scab.—This appears on tubers as discolored, slightly raised blotches which gradually form pits, and these become filled with brownish dust. Although it has been troublesome in Northern Europe for many years its introduction in some localities in the Maritime Provinces and in a few of the States of the

American Union has been quite recent. It is still unknown in Ontario, but as potatoes are being imported from the Maritime Provinces to Ontario there is danger of its introduction into this Province, even though certain precautions are taken to prevent it. If potatoes are seen in Ontario which cause suspicion, samples should be sent at once to Professor J. E. Howitt, Botanist, Ontario Agricultural College, Guelph, or to Dr. H. T. Gussow, Botanist, Central Experimental Farm, Ottawa.

TREATMENTS FOR THE COLORADO POTATO BEETLE.

(*Doryphora decemlineata*).

The Colorado Potato Beetle was first found about ninety-five years ago in the Western part of the United States, near the base of the Rocky Mountains, where it was feeding on wild plants closely related to the potato. It was not, however, until about 1860 that it became troublesome in the potato gardens of the Central-Western States. From this section of the country it gradually moved eastward and later crossed the Atlantic to Europe. It has been one of the greatest pests in connection with potato production. The orange-colored eggs are laid in masses on the underside of the potato leaves. They hatch in a few days, and the grubs feed on the potato plants for a few weeks, when they descend to the ground and rest under rubbish or immediately below the surface, where they change into the pupæ form. In about ten days perfect beetles appear on the potato plants. There are usually two or three broods in the one season, and the beetles pass the winter in the adult form.

For twelve years in succession an experiment was conducted in duplicate by using different methods for destroying the Colorado Potato Beetle. The experiment consisted in treating the potato plants with Paris green and water, Paris green and plaster, and Potato Bug Finish. In nearly all seasons three applications were made on each crop. The solution was sprinkled from watering-cans and the powder was applied from perforated tins. As a basis of comparison one plot was allowed to remain untreated. All cultural methods were similar for the different plots, with the exception of the treatment referred to. After the experiment had been conducted in each of six years two other treatments were added consisting of Commercial Bug Death, the material being used in the dry condition and with water.

In each of the past six years, therefore, six lots of each of two varieties of potatoes were carefully selected and planted on separate plots. After the potatoes had made sufficient growth and the Colorado Potato Beetles had made their appearance five plots of each variety were treated in different ways to destroy the beetles, and one plot of each variety was left untreated. The five treatments made in each of the years were as follows: 1st, Paris green and water, by using one pound of Paris green and 96 gallons of water per acre; 2nd, Paris green and plaster, by using one pound of Paris green and 38 pounds of plaster per acre, and applying the mixture to the potato plants in the dry condition; 3rd, Potato Bug Finish, by using the material in the dry form at the rate of 20 pounds per acre; 4th, Bug Death and water, by using on an average 32 pounds of Bug Death and 96 gallons of water per acre; and 5th, Bug Death, by using 32 pounds of the material per acre in the dry condition.

The average results in bushels of potatoes per acre per annum of the smaller experiment conducted for twelve years, and of the larger experiment conducted for **six years** are as follows:—

Treatment for Potato Beetles.	Average Yield of Potatoes per Acre per Annum (bushels).	
	12 years. 24 tests.	6 years. 12 tests.
Not Treated	87.1	88.2
Potato Bug Finish	120.7	128.9
Paris Green and Plaster	159.3	175.6
Paris Green and Water	160.9	186.9
Bug Death Dry	....	197.7
Bug Death and Water	....	203.4

In ten out of twelve years those potatoes which were sprinkled with Paris green and water surpassed those which were dusted with Paris green and plaster in yield of crop per acre. In each of the twelve years the untreated potatoes gave decidedly the lowest yield of tubers. In the experiment conducted for the shorter period the Bug Death gave the highest production in five out of the six years. In four out of the six years the Bug Death in solution gave better results than the same amount of material applied in the dry condition. In the average of the six years' experiment the Bug Death and water gave a yield of potatoes per acre per annum of 5.7 bushels over the Bug Death, dry, 16.5 bushels over the Paris green and water, and 27.8 bushels over the Paris green and plaster. The usual prices of these insecticides when bought in quantity were about as follows: Paris green 20 cents, Bug Death 7.5 cents, and Potato Bug Finish 1 2-3 cents per pound. The average cost per annum, therefore, for each material used in the experiments conducted in the last six years, when three applications were made each season, was approximately as follows: Paris green and water 60 cents, Paris green and plaster 88½ cents, Bug Death $7.20, and Potato Bug Finish $1 per acre.

The Bug Death is an insecticide which has been sold in Ontario for fully sixteen years. It was analyzed by the Chemical Department at the College in 1902 and again in 1903, and gave the following average percentage composition: Moisture .36, volatile matter 2.77, sand, etc., 3.72, lead oxide 3.94, zinc oxide 85.25, and iron oxide 3.96. It will be seen that the bug death is composed largely of crude zinc oxide, with smaller quantities of the oxides of lead and of iron. The plant food which the Bug Death contained was about one-half of one per cent. of ammonium sulphate, which is not much more than a trace. For good results as an insecticide it needs to be used in fairly large quantities, and is, therefore, rather expensive. When considering the yields of potatoes in the foregoing table the cost of material should be taken into consideration.

Another experiment was started in 1909 in testing different proportions and different preparations of lead arsenate in comparison with Paris green for the prevention of the ravages of the potato beetle. The experiment consisted of eleven plots. Four of these received varying quantities of Paris green and of water, three of commercial lead arsenate, three of home-made lead arsenate, and one plot was left untreated. The commercial lead arsenate was obtained from the Cold Storage and Forwarding Company, of St. Catharines, Ontario, and was the same as is used extensively in the Niagara fruit district. The home-made preparation consisted of the following formula for the weakest solution:—

Arsenate of Soda	10 ounces.
Acitate of Lead	24 "
Water	150 gallons.

The medium strength was prepared by using 112½ gallons, and the strongest solution by using 75 gallons of water and the same quantities of the other constituents as above indicated. These three solutions were each used at the rate of forty gallons per acre for each application. The material was applied to the plants by spraying with a watering-can furnished with a specially made attachment for producing a fine spray. The experiment was conducted in duplicate each year, and in each of five seasons, thus making ten separate tests. An early variety and a late variety of potatoes were used each year. In the five-year period fourteen applications were made, or an average of practically three sprayings per year

In the average results of the five years' experiment it was found that the commercial lead arsenate applied at the rate of three pounds per acre with forty gallons of water gave 205.9 bushels of potatoes per acre per annum. This was a higher yield than that made by any other treatment. It gave slightly better results than either two or four pounds of commercial lead arsenate per acre. One pound of Paris green with forty gallons of water gave an average of 202 bushels of potatoes per acre per annum, which was a higher yield than that produced from one pound of Paris green and ninety-six gallons of water, or from one and one-half pounds of Paris green with forty gallons of water. Forty gallons per acre of the strongest solution of the home-made preparation of lead arsenate gave an average annual yield of 190 bushels of potatoes. The approximate cost per acre for each of the three best treatments here referred to was as follows: One pound of Paris green, 20 cents; three pounds of commercial lead arsenate, 26.4 cents; and eighteen ounces of the home-made preparation, or the strongest solution of lead arsenate, 23.7 cents. To obtain the cost of each per acre per season these amounts would need to be multiplied by the number of applications.

The treatment recommended at the Central Experimental Farm, Ottawa, is from eight to ten ounces of Paris green, from one and one-half to two pounds of arsenate of lead and forty gallons of water per acre.

Twenty-one separate examinations were made of the number of potato beetles per plant a few days after the first treatment and of the percentage of foliage eaten a few days after the second and the third treatments in the season. The examinations were made of each of the eleven plots on each occasion. The summary results of all these examinations are interesting, and are presented in the following table:—

Materials.	Number of Tests.	Average Number of Beetles per Hill after the First Application.	Number of Tests.	Average Percentage of Foliage eaten by the Beetles after the Second and the Third Applications.
Paris Green and Water (4 preparations)	32	3.3	54	5.0
Lead Arsenate (Commercial) (3 preparations)	24	4.0	39	8.1
Lead Arsenate (Home-made) (3 preparations)	24	10.7	39	33.1
Hand Picking	8	2.8	13	14.9

It will be seen that on the average after the first treatments were made the smallest number of beetles was found after hand-picking, the second smallest number after the use of Paris green, and the largest number where the home-made lead arsenate had been applied. In the average percentage of foliage eaten the smallest amount was where Paris green had been used, and the largest amount where the home-made preparation of lead arsenate had been sprayed on the vines.

A short time ago a material called Phenyle was advertised as a treatment for sprinkling seed potatoes to protect them from the bugs or beetles. The Department of Field Husbandry received a can of the material, gratis, for experimental purposes. An experiment consisting of three plots was conducted. For one plot the potatoes were sprinkled lightly, for another they were sprinkled heavily with the Phenyle, and for the third plot the potatoes were left untreated. The experiment was conducted in duplicate. From careful observations made, no beneficial results whatever were seen from the application of the material in either preventing the beetles from working on the vines or in increasing the yield of potatoes per acre.

METHODS OF HANDLING THE POTATO CROP FOR SATISFACTORY RESULTS.

The adoption of the most improved method of cultivating potatoes of the best variety is necessary for the highest returns from the land. After the crop is produced, however, much care is required in handling the potatoes if the ultimate results are to be the most satisfactory.

Davies' Warrior variety of Potatoes grown in the Experimental grounds at the Ontario Agricultural College.

Digging.—If the potatoes are grown for very early market they are often dug when about two-thirds grown, which is probably from eight to twelve weeks after planting. The crop at this time is frequently dug with a potato fork owing to the abundance of the green tops and the tender condition of the skin of the immature tubers. One man can dig by hand from one-eighth to one-half of an acre per day. Carefully handled potatoes are decidedly the most attractive and command the highest prices.

The potatoes of the general crop can usually be dug to advantage after they have become ripened and the tops have been dead for ten days or two weeks. The method of digging the potatoes depends largely upon the area of land used for the crop. If the potatoes are grown in a garden or in a small lot the potato fork is generally used. When the crop is produced in long rows, however, the ordinary plow or the double mould-board plow with special attachments is frequently brought into service. If it is the intention to grow more than an acre or two of potatoes annually a two-horse potato plow with forked appendages for leaving the potatoes on the top of the soil can be used economically. There are different makes of these potato plows in Ontario, and the usual prices are about the same as those of ordinary plows. When potatoes are grown extensively for commercial purposes an elevator potato digger is almost essential. There are a number of different styles of these diggers manufactured at the present time which usually sell for one hundred dollars and upwards according to the size and the make. They are operated by two or by four horses, and the capacity of a machine is from three to four acres, or from five to twelve hundred bushels per day.

Extra Early Eureka variety of Potatoes grown in the Experimental grounds at the Ontario Agricultural College.

Sorting and Grading.—The sorting of potatoes for early market takes place largely in the field. When the potatoes are scattered on the surface of the soil there is a good opportunity for gathering the perfect tubers of the right size for market or for home use. The remainder can be gathered and used for feeding stock. It is unusual for the early potatoes to have many culls, excepting those which are too small for market.

In harvesting the late crop care should be taken not to allow the potatoes to lie in the hot sun longer than is necessary. The potatoes should be gathered in dry weather. If the patch is not large the sorting can be done at the time of gathering by first picking up the sound, smooth, marketable tubers, and by leaving for the second picking the small, irregular, scabby potatoes, and especially any which have started to decay. If the area used for the crop consists of a few acres, however, it is an excellent plan to run the potatoes through a potato-grader and to sort the tubers by hand at the same time. This can be done either in the field at the time of harvest or at some convenient place before the potatoes are stored for the winter. Only the very best potatoes should be stored. All small, irregular, unsound and diseased tubers should be boiled and fed to stock or disposed of in some other way as soon as possible. There are several kinds of potato-graders on the market at the present time which do fairly good work. The proper grading of potatoes is sure to receive more attention in the future than it has received in the past.

Storing.—If potatoes are grown only for home use the crop is usually stored in the cellars of the houses or of the barns. Occasionally potatoes are stored in pits. When the crop is grown commercially, however, it is generally placed in a potato storage cellar erected for the purpose. In all cases it is important to store only well sorted, sound, clean, dry potatoes and to keep them constantly in a dry, cool, dark and well ventilated place. The temperature usually recommended for the best results is from 33 degrees F. to 35 degrees F. It is stated[1] that potatoes when placed in storage shrink about two per cent. per month for a period of six or seven months.

Marketing.—The potato grower should cater to the wishes of the most particular and exacting customers. He should furnish a choice product in a most attractive form and should carefully study the demands of the market he wishes to serve. For the best prices the potatoes should be uniform, sound, smooth and of good table quality, whether selected by the pound, the basket, the bushel, the bag, the barrel or the car load. The commercial potato grower should not be confined to the local market, but should be in a position to put his potatoes on the best market available either through his own efforts or through the medium of a co-operative association. It sometimes occurs that of the price paid by the consumer for a bushel of potatoes about two-thirds are required to defray the cost of transportation and of distribution, and one-third is left for the grower. This is not as it should be. Undoubtedly one of the best remedies for such a condition of affairs is co-operation on the part of the growers themselves. This matter is discussed under the heading of "Organized Agencies in Connection with Potato Production" in another part of this bulletin.

COST PER ACRE OF GROWING POTATOES.

The cost of producing an acre of potatoes varies with the season, the soil, and the area of the crop; with the kind of machinery used, and the method of culture followed; with the price placed on the labour of the men and on that of the horses; and with the amount allowed for cost of seed, interest on money invested, rent of land, fertilizers used, etc. The writer has in his office estimates worked out in detail and printed in reports issued in Ontario and in the Northern States giving the cost of producing potatoes, and these vary from $15 to $60 per acre. It is not necessarily true that the greatest cost per acre will give the least profit, nor that the smallest cost per acre will give the highest profit. Exactly the opposite may be true. Much depends upon management and upon local conditions.

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[1] The Encyclopedia Americana, Volume XII.

Mr. W. T. Macoun, Central Experimental Farm, Ottawa, has placed the cost[1] of producing three hundred bushels of potatoes on an acre of land at $52.14.

The average cost of producing acre lots of potatoes in Ontario for the years 1913 and 1914, as determined by the twenty-three young men who took first prizes in the Acre Profit Competitions conducted by the Department of Agriculture, through the District Representatives, was $39.75. The average yield of potatoes per acre for the two years was two hundred and seventy-seven bushels.

In 1915, M. H. Goltz, Muskoka, Ontario, produced a yield of five hundred and fourteen bushels of Davies' Warrior potatoes on an acre of land, and at an estimated cost of $42.02. This was the highest production for the year made in the Acre Profit Competitions conducted throughout Ontario.

ORGANIZED AGENCIES IN CONNECTION WITH POTATO PRODUCTION.

In growing potatoes in Ontario farmers may work independently of each other or they may co-operate with some organization which is working in a definite and systematic way. The work of some of these organized agencies will probably be increased in the near future.

Ontario Agricultural and Experimental Union.—There is but little excuse for any farmer in Ontario to grow for himself or to sell to his neighbors any but the very best varieties of potatoes. The safest way is to use the carefully tested varieties and not to rely on highly advertised sorts which are sold at double prices to the profit of the seller and to the risk of the buyer. Many of the new and of the old varieties are carefully grown at the Ontario Agricultural College in comparative tests. The results of the experiments are reported frequently. Particular attention is directed to those kinds possessing the best combination of the desirable characteristics and which make the most satisfactory records.

Potatoes of two or three choice varieties are distributed each year through the medium of the Ontario Agricultural and Experimental Union to be tested on the various soils of the Province by the farmers who wish to conduct the tests, and who apply for the material. Leading varieties of potatoes now grown in Ontario such as Rural New Yorker No. 2, Empire State, Carman No. 1, Green Mountain and Early Ohio were introduced in this way. In the past three years only two varieties have been distributed, viz., Davies' Warrior and Extra Early Eureka. Other co-operative experiments with potatoes which might be mentioned deal with methods of cultivation, preparation of seed, cutting and planting of tubers, application of commercial fertilizers, farmyard manures, etc. The Experimental Union is an organization under the *Agricultural Associations Act* and receives a grant from the Ontario Government. It has about five thousand co-operative experimenters throughout the Province. Its headquarters are located at the Ontario Agricultural College, Guelph, and its Secretary is the author of this bulletin. The results of the co-operative experiments are published annually in the reports of the Experimental Union, copies of which are obtainable from the Department of Agriculture, Parliament Buildings, Toronto.

Canadian Seed Growers' Association.—This is a Canadian organization which receives a grant from the Dominion Government and has its headquarters at Ottawa. According to the constitution of the Association the main object is to advance the interest of seed growers and other farmers by:—

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[1] The Potato and Its Culture, Bulletin No. 49, Central Experimental Farm, Ottawa.

"(*a*) Making regulations respecting the growing, selecting and preserving of seed of various kinds of farm crops for the guidance of its members;

"(*b*) Causing records to be kept of the history of seeds produced by members;

"(*c*) Fixing standards for seeds that may be eligible for registration;

"(*d*) Publishing information as to standards;

"(*e*) Issuing certificates of registration to members by which hand-selected seed or the product thereof may be distinguished from other seed;

"(*f*) Such other means as may be expedient from time to time."

A meeting of the Association is held annually in Ottawa. Reports of work accomplished and catalogues of pedigreed seed for sale by the members are issued from time to time. An interesting line of work in selection as it applies to potato production has been devised for the improvement of this crop. One regularly organized seed centre for potato production has been started under the name of the Manvers Green Mountain Potato Centre, and is located at Pontypool, Ontario. Other centres are likely to be organized in the near future. Particulars regarding the work in potato selection and the establishment of Seed Centres are available on application to Mr. L. H. Newman, Secretary, Canadian Seed Growers' Association, Canadian Building, Ottawa.

Acre Profit Competitions.—The Ontario Department of Agriculture has inaugurated, through the District Representatives, Acre Profit Competitions with potatoes and other farm crops. The County Competitions have been conducted for three years and are confined each season to the farmers' sons who complete the Agricultural Courses of from four to six weeks held by the District Representatives. The work has been very valuable in showing the advantages of good seed and of thorough cultivation, and in demonstrating the financial possibilities of an acre of land. The person in each competition making the highest score is given a

At the Provincial Winter Fair held in Guelph in December, 1915, this lot of Davies' Warrior Potatoes, grown by Mr. H. L. Goltz, took Second Prize in the entries in connection with the Field Crop Competitions open to all varieties.

free course of two weeks in Stock and Seed Judging at the Ontario Agricultural College, the expenses being paid by the Department of Agriculture.

The following table gives the average results of the first prize records in the County Competitions with potatoes:—

Years.	Number of Competitions with Potatoes.	Average Yield of Potatoes per Acre (bushels).	Average Cost of Production per Acre.	Average Profit per Acre.
1913	7	258	$38.64	$114.84
1914	16	337	40.43	91.71
1915	19	271	40.06	154.25

For information regarding the County Short Courses or the Acre Profit Competitions, applications should be made to the District Representatives or to Mr. C. F. Bailey, Assistant Deputy Minister of Agriculture, Parliament Buildings, Toronto.

Field Crop Competitions.—In 1907 Standing Field Crop Competitions were started in Ontario with cereals, and in 1908 potatoes were added to the list. The work during the past eight years has been conducted through the medium of the Agricultural Societies of Ontario. Each society entering potatoes must have at least ten fields in competition. In each potato competition fifty dollars is granted by the Government, and twenty-five dollars by the Agricultural Society, which amount is divided into the following prizes: Twenty, fifteen, twelve, ten, eight, six and four dollars. The official judges are furnished by the Government, and the potatoes are judged according to the following scale of points:

General Appearance	15
Freedom from Blight and Insects	17
Method and Thoroughness of Cultivation................	20
Purity of Variety	10
Apparent Yield	38
Total	100

The entries each year number several hundred, and the competition is keen and wholesome. An Appendix to the Annual Report of the Agricultural Societies is published each year by the Ontario Department of Agriculture, and contains the name and address of each competitor, the name of the variety of potatoes entered, and the score of points allotted to the crop. For information regarding the work of the Field Crop Competitions the reader is referred to Mr. J. Lockie Wilson, Superintendent of Agricultural Societies, Parliament Buildings, Toronto.

Potato Growing Contest for Boys.—Through the kindness and the liberality of Mr. R. B. Whyte, of Ottawa, who donated the prizes, a potato growing contest for boys between the ages of twelve and eighteen years has been conducted for four seasons in Carleton County, and for three seasons in Russell County. An average of twenty-eight boys conducted the work in each of the past three years. The size of each plot was one-tenth of an acre, and from the returns of the plots the results per acre were determined. The prizes were awarded on the following basis:

Report of Inspector on thoroughness of field culture, etc.	100	points.
Certified report of yield as submitted by competitor	100	"
Award of Judges one bushel exhibit sent to County Fair	100	"
Written report of competitor showing expenses, profits, etc	100	"

In 1915 the average net profit per acre was $100 in Carleton County and $113.87 in Russell County. In the average of all the plots in the two counties the estimated cost of producing a bushel of potatoes was 21.3 cents in 1915, 22 cents in 1914, and 34.8 cents in 1913.

The following scale of points was used in judging the potatoes at the County Fairs:

Purity of Variety	10	points.
Uniformity	10	"
Size	10	"
Smoothness	10	"
Shape	5	"
Nature of Skin	5	"
Color	10	"
Freedom from Disease	15	"
Quality	25	"
Total	100	"

The potato growing contest in operation in these two counties is suitable for adoption in other places. Persons interested in the scheme and desiring information should write for full particulars to the Secretary, Mr. L. H. Newman, Canadian Building, Ottawa.

Potato Growers' Co-operative Associations.—In some parts of Ontario potatoes of excellent quality are grown rather extensively for commercial purposes. These potato growing districts have special opportunities for earning for themselves good reputations by furnishing potatoes which will command the highest prices in our best markets. In order to bring this about, however, a united effort on the part of the growers seems essential. The real value of a Co-operative Association depends largely upon the organization being established on sound and up-to-date business principles, and upon the loyalty and co-operative spirit of the members. A properly organized and established Potato Growers' Association could grow one or two of the most suitable varieties of potatoes, grade the crop into uniformity, give the product the stamp of the Association, and distribute in carload lots when necessary. The officers could keep in constant telegraphic communications with the best markets, and thus secure a wide distribution and avoid shipping to centres already over-stocked. By supplying potatoes in large lots in this way the cheapest transportation could be obtained and the best service secured, or the supply might be sent forward f.o.b. (free-on-board) shipping point. The growers would thus be enabled to secure the just returns for their crop, to avoid many discouragements, and to place the produce with the consumer in the best condition and at a reduced price. Advantages would accrue, therefore, to both the producers and the consumers.

The following local Co-operative Associations have been organized in Ontario for handling potatoes alone or in conjunction with other farm crops:—

Hillsburg Potato Growers' Association: R. D. Nodwell, Sec., Wellington Co.

The Rainy River Potato Growers' Association: A. G. Crawford, Mgr., Rainy River Dis.

Independent Vegetable Growers' Association: Henry Broughton, Mgr., Lambton Co.

Lambton Co-operative Association: Geo. French, Mgr., Lambton Co.
Blezard Valley Association: Leandre Prevost, Sec., Nipissing Dis.
Farmers' Co-operative Association: Henri Bourassa, Sec., Nipissing Dis.

If the separate Co-operative Associations could be organized so as to embody uniformity in essential business principles and methods, and so as to allow certain variations to meet important local conditions a great advancement would be made. This would in time permit of the establishment of a central or Provincial organization which would unify and strengthen the local Associations. Potato growers wishing to form a local Co-operative Association should write to Mr. F. C. Hart, Director, Co-operation and Markets Branch, Department of Agriculture, Parliament Buildings, Toronto.

THE FARMER FEEDS THE PEOPLE.

According to the present production and consumption in Ontario from twenty-five to thirty people, or from five to six families are supplied with potatoes for one year from each average acre of land which the farmer plants with this crop. An increase of fifty per cent. in yield would mean an increase in the quantity of potatoes produced on each average acre of land sufficient to supply about one dozen people for twelve months. In most years Ontario imports potatoes from the Maritime Provinces, and at the present time a part of our supply is coming from the Province of Alberta. Ontario is well adapted to the production of potatoes of excellent quality and should supply at least her own demands. It is to be hoped that the information furnished in this bulletin may be instrumental in increasing both the quality and the quantity of Ontario's potato crop.

The man who grows good potatoes when potatoes are needed is a public benefactor.

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